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(BRITISH)

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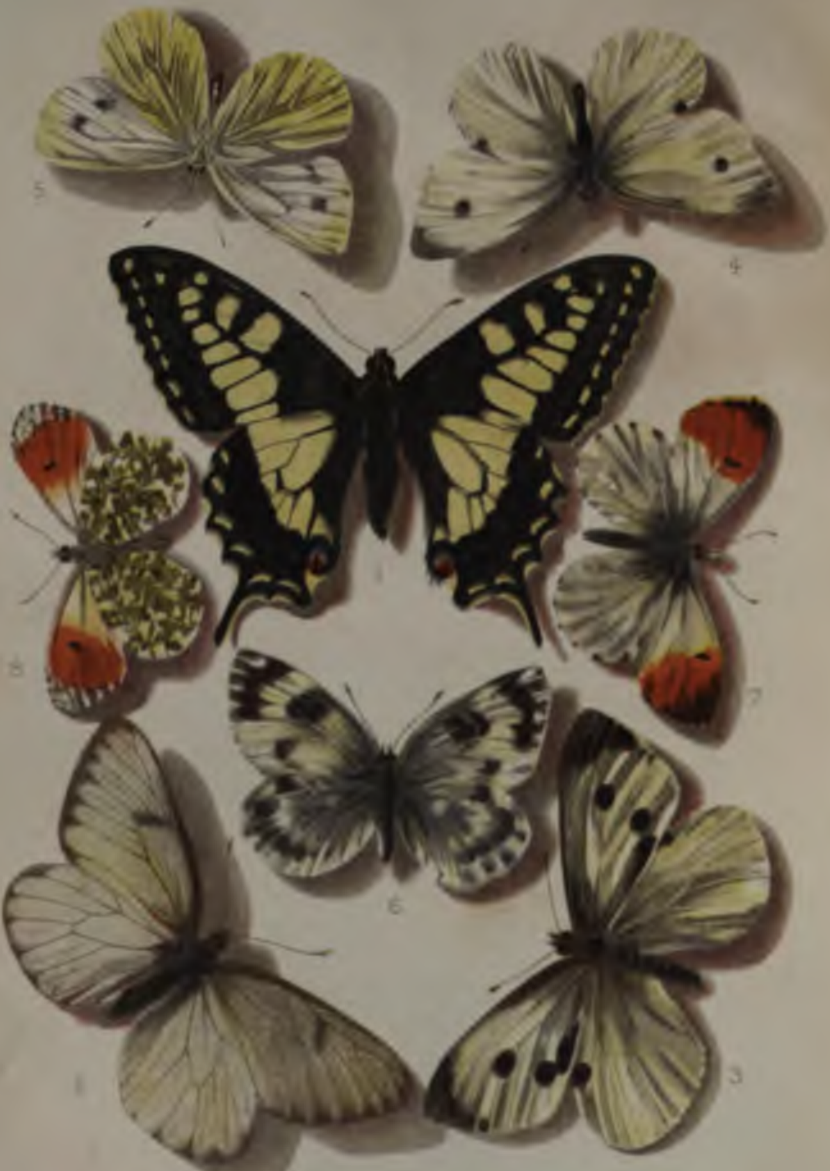

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BUTTERFLIES AND MOTHS

(BRITISH)

BY

W. FURNEAUX, F.R.G.S.

AUTHOR OF 'THE OUT-DOOR WORLD, OR YOUNG COLLECTOR'S HANDBOOK'

WITH TWELVE COLOURED PLATES
AND NUMEROUS ILLUSTRATIONS IN THE TEXT

LONDON
LONGMANS, GREEN, AND CO.
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1894

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PREFACE

The favourable reception with which the 'Out-door World' has been greeted has encouraged the publishers to issue a series of volumes dealing in fuller detail with the various branches of Natural History treated of in that work. Necessarily each subject was only briefly touched upon, but the study is of so enticing a character that 'appetite grows by feeding,' and the students of the 'Out-door World,' having tasted the sweetness of companionship with Nature, will not rest satisfied with the help afforded by that handbook. Each one will want to go deeper into that particular department which most appeals to his own inclinations.

The present volume is written expressly for those who desire to extend their knowledge of the British Lepidoptera, or, to use the more popular names, 'Butterflies and Moths.'

The general characteristics of this interesting order of insects are described somewhat fully, but, of course, it would be impossible to give an individual account of all the British Lepidoptera in a work of this size, so a selection has been made such as will satisfy the requirements of the great majority of those who intend to take up this particular branch of entomology. The number of British Butterflies, however, is so limited that a place has been found for a figure and a description of every species; and, of the larger moths, many of the common and typical kinds have been included. An introduction to the study of the Micro-lepidoptera has also been added.

No trouble has been spared to render this work thoroughly practical. In addition to the verbal descriptions of so many species, twelve coloured plates and a large number of woodcuts have been specially prepared to help the student in his work. It is believed that the extreme care with which these have been produced will render them of the greatest assistance to the collector in the recognition of his specimens.

But he has not only to recognise his specimens—he must first catch them; and here full directions have been given to insure success in this part of his work, as well as in the management, preservation, and arrangement of his captures.

The Author hopes that this volume may be the means of adding many happy hours—hours of the purest enjoyment to the lives of those whom he has succeeded in luring into the fields and lanes and woods of the Out-door World.

CONTENTS

PART I

STRUCTURE AND LIFE HISTORY OF THE LEPIDOPTERA

CHAP. PAGE
I. GENERAL CHARACTERS 1
II. THE EGG 16
III. THE LARVA 22
IV. THE PUPA OR CHRYSALIS 40
V. CLASSIFICATION OF THE LEPIDOPTERA 55

PART II

WORK AT HOME AND IN THE FIELD

VI. CATCHING BUTTERFLIES AND MOTHS 63
VII COLLECTING OVA, LARVÆ, AND PUPÆ 98
VIII. REARING LEPIDOPTERA 112
IX. SETTING AND PRESERVING 122
X. PRESERVING OVA, LARVÆ AND PUPÆ 130
XI. THE CABINET – ARRANGEMENT OF SPECIMENS 134

PART III

BRITISH BUTTERFLIES

XII. THE SWALLOW-TAIL AND THE 'WHITES' 139
XIII. THE FRITILLARIES, VANESSAS, AND THE PURPLE EMPEROR . 154
XIV. THE BROWNS AND HEATHS 173
XV. THE HAIRSTREAKS, COPPERS AND BLUES 183
XVI. THE DUKE OF BURGUNDY AND THE SKIPPERS 196

PART IV

COMMON BRITISH MOTHS

CHAP. PAGE
XVII. SPHINGES 203
XVIII. BOMBYCES 217
XIX. THE NOCTUÆ 239
XX. GEOMETRÆ 268
XXI. THE MICRO-LEPIDOPTERA 290

APPENDICES

I. COMPLETE CLASSIFIED LIST OF BRITISH MACRO-LEPIDOPTERA . 309
II. THE LEPIDOPTERIST'S CALENDAR 326

REFERENCES TO COLOURED PLATES 347

INDEX 351

LIST OF ILLUSTRATIONS

COLOURED PLATES

1-7. British Butterflies . . . . . . Frontispiece
8. Larvæ and Pupæ of British Butterflies
9. Sphinges . . . .
10. Bombyces . . . . At end
11. Noctuæ . . . .
12. Noctua and Geometræ . . . . .

Full references accompany the Plates.

ILLUSTRATIONS IN THE TEXT

FIG. PAGE
1. Scales from the Wings of Butterflies 1
2. Portion of the Wing of a Butterfly from which some of the Scales have been removed 2
3. Body of a Butterfly—Under Side 3
4. Section of the Eye of an Insect 4
5. Antennæ of Butterflies 5
6. Antennæ of Moths 5
7. Section of the Proboscis of a Butterfly 7
8. Diagram of the Wings of a Butterfly 9
9. The Undeveloped Fore Leg of a Butterfly 10
10. The Four Stages of the Large White Butterfly (*Pieris Brassicæ*) 14
11. Egg of the Meadow Brown Butterfly 20
12. Egg of the Speckled Wood Butterfly 20
13. Egg of the Vapourer Moth 20
14. The Caterpillar of the Clouded Yellow Butterfly . . 22
15. The Caterpillar of the Dark Green Fritillary Butterfly 23

FIG. PAGE
16. The Caterpillar of the Purple Emperor Butterfly 24
17. An Ichneumon Fly (*Cryptus Migrator*) . . . 25
18. Another Ichneumon Fly (*Pimpla Instigator*) . 25
19. The Caterpillar of the Angle Shades Moth (*Meticulosa*) . 26
20. Walking Leg of a Caterpillar 28
21. Larva of the Yellow Underwing Moth (*Pronuba*) . 28
22. Larva of the Crimson Speckled Moth (*Pulchella*) . 28
23. Larva of the Lobster Moth (*Fagi*) 28
24. Caterpillar of the Iron Prominent Moth (*Dromedarius*) . 29
25. Larva of the Brimstone Moth (*Luteolata*) . . . 29
26. The Claspers of a Caterpillar 30
27. The Homes of Leaf Miners and Leaf Rollers . 33
28. The Cocoon of the Emperor Moth 40
29. The Cocoon of the Six Spotted Burnet (*Filipendulæ*) 40
30. The Pupa of the Privet Hawk (*Ligustri*) . . . 44
31. The Chrysalis of the Large White Butterfly (*Brassicæ*) . 44
32. The Pupa of the Dark Green Fritillary (*Aglaia*) 45
33. The Pupa of the Black-veined White Butterfly (*Cratægi*) [illegible]
34. The Pupa of the Currant Moth . 45
35. Pupa of the Pale Tussock Moth (*Pudibunda*) 45
36. A Butterfly just after Emerging [illegible]
37. A Butterfly at Rest (Large Copper) 57
38. A Moth at Rest (Gothic) 57
39. A Wire Frame for a Butterfly Net 65
40. Stick for the Net . . . 65
41. The Metal Y 66
42. Pattern for the Net 67
43. The Cyanide Bottle . . 68
44. Section of the Laurel Box . . . 70
45. The Chloroform Bottle . . 72
46.
47.
48. Fittings for the Collecting Box 75
49.
50. Frame of Net for Collecting Insects on Lamps and Windows 87
51. A Trap for Catching Moths . . 88
52. Metal Joint for Lantern and Net . 91
53. Net and Lantern for Taking Moths from High Branches 91
54. Frame for the Sugaring Net . 94
55. Cage for Decoy Females 96
56. A Sugar Trap [illegible]
57. A Larva Glass 114
58. A Larva Glass 114
59. A Larva Cage . . 115
60. Section of a Setting Board . . . [illegible]
61. Sections of Setting Boards . . . 125

FIG. PAGE
62. A Butterfly on the Setting Board . . . 124
63. Another Method of Setting Butterflies and Moths . 125
64. A Blowpipe for Larvæ . . . 131
65. The Bath White—Under Side . . . 147
66. The Clouded Yellow—Female . . . 151
67. The Small Pearl-bordered Fritillary—Under Side . . 155
68. The Pearl-bordered Fritillary—Under Side . . . 156
69. The Queen of Spain Fritillary—Under Side . . . 157
70. The Dark-green Fritillary—Under Side . . . 158
71. The High-brown Fritillary . . . 159
72. The Silver-washed Fritillary—Under Side . . . 160
73. The Greasy Fritillary—Under Side . . . 161
74. The Glanville Fritillary—Under Side . . . 162
75. The Comma—Under Side . . . 164
76. The Purple Emperor—Under Side . . . 172
77. The Marbled White—Under Side . . 174
78. The Wood Argus—Under Side . . . 176
79. The Grayling—Under Side . . . 178
80. The Large Heath—Under Side . . . 179
81. The Ringlet—Upper Side . . . 180
82. The Marsh Ringlet—Under Side . . . 181
83 The Brown Hairstreak—Male . . . 184
84 The White-letter Hairstreak . . . 184
85. The Purple Hairstreak—Male . . . 186
86. The Green Hairstreak . . . 186
87. The Tailed Blue—Under Side . . . 188
88. The Silver-studded Blue—Under Side . . . 189
89. The Common Blue—Under Side . . . 191
90. The Clifden Blue—Under Side . . . 191
91. The Chalk-hill Blue—Under Side . . . 192
92. The Holly Blue—Under Side . . . 193
93. The Mazarine Blue—Under Side . . . 194
94. The Small Blue—Under Side . . . 194
95. The Large Blue—Under Side . . . 195
96 The Silver-spotted Skipper—Under Side . . . 201
97. The Death's-head Hawk Moth . . . 205
98. The Larva of Atropos . . . 206
99. The Caterpillar of Euphorbiæ . . . 207
100. The Small Elephant Hawk Moth . . . 208
101. The Poplar Hawk . . . 209
102. The Broad-bordered Bee Hawk . . . 212
103. The Hornet Clearwing of the Poplar . . . 213
104. The Currant Clearwing . . . 213
105. The Forester . . . 214
106. The Six-spotted Burnet . . . 215
107. The Larva of Filipendulæ . . . 215
108. The Green Silver-lined . . . 217

FIG. PAGE
109. The Short-cloaked Moth . 218
110. The Muslin Moth . 218
111. The Common Footman . . 219
112. The Larva of Jacobeæ . . 219
113. The Scarlet Tiger 220
114. The Buff Ermine 222
115. The White Ermine 222
116. The Ghost Swift—Female . . . 223
117. The Common Swift 224
118. The Goat Moth 225
119. The Larva of Ligniperda (less than half full size) 225
120. The Leopard Moth 226
121. The Larva of Pyrina (only partly grown) 226
122. The Brown Tail . . 227
123. The Gipsy—Male . . 227
124. The Black Arches—Male 228
125. The Vapourer Moth—Male . 228
126. The Female Vapourer . 228
127. Larva of the Vapourer Moth . 229
128. The Drinker—Male . . . 230
129. The Oak Hook Tip . . 233
130. The Chinese Character 233
131. The Poplar Kitten . . . 234
132. The Puss Moth . 235
133. The Coxcomb Prominent . . 235
134. The Larva of Bucephala . . . 236
135. The Chocolate Tip 237
136. The Peach Blossom . . 237
137. The Yellow Horned . . . 238
138. The Marbled Beauty . . 240
139. The Grey Dagger . 240
140. The Poplar Grey . . 241
141. The Figure of Eight . 241
142. The Brown-line Bright-eye . 242
143. The Smoky Wainscot . . . 243
144. The Common Wainscot . 243
145. The Bulrush . . . 244
146. The Frosted Orange . 245
147. The Flame . . . 245
148. The Light Arches . . 246
149. The Flounced Rustic . 246
150. The Cabbage Moth . 247
151. The Dart . . . 247
152. The Rustic Shoulder-knot . . . 248
153. The Marbled Minor 248
154. The Mottled Rustic 249
155. The Turnip Moth 250

FIG. PAGE
156. The Heart and Dart 251
157. The Garden Dart 251
158. The Flame Shoulder 252
159. The Lesser Broad Border 252
160. The Lesser Yellow Underwing 253
161. The Gothic 254
162. The Old Lady 254
163. The Common Quaker 255
164. The Chestnut 256
165. The Pink-barred Sallow 256
166. The Dunbar 257
167. The Broad-barred White 257
168. The Angle Shades 258
169. The Grey Arches 259
170. The Shears 260
171. The Bright-line Brown-eye 260
172. The Early Grey 261
173. The Shark 262
174. The Burnished Brass 263
175 The Silver Y 264
176. The Red Underwing 266
177 The Light Emerald 270
178 The August Thorn 271
179. The Peppered Moth 272
180. The Willow Beauty 273
181. The Large Emerald 274
182. The Common Emerald 274
183. The Lace Border 275
184. The Riband Wave 276
185. The Blood-vein 276
186. The Common Wave 277
187. The Clouded Silver 277
188. The V Moth 278
189. The Common Heath 279
190. The Bordered White—Male 279
191. The Currant Moth 280
192. The Spring Usher 281
193. The March Moth 282
194. The November Moth 282
195. The Twin-spot Carpet 283
196. The Grass Rivulet 283
197. The Netted Pug 284
198. The Narrow-winged Pug 284
199. The Brindled Pug 284
200. The Small Seraphim 285
201. The Blue-bordered Carpet 285

FIG. PAGE
202 The Beautiful Carpet . . . 286
203 The Common Carpet 286
204 The Silver Ground Carpet . 287
205 The Garden Carpet . . . 287
206. The Yellow Shell . . 288
207 The Small Phoenix 288
208. The Small Mallow 289
209 The Tabby or Grease Moth 291
210 The Meal Moth 292
211. The Small Magpie 292
212. The Mother-of-Pearl 293
213 The Garden Pebble 293
214. The Beautiful China Mark 294
215 Gonodactyla 295
216 Osteodactylus 295
217. Pentadactyla 295
218. Hexadactyla—Enlarged . . . 296
219. Phragmitellus—Enlarged one-half . . 297
220 Hamellus—Slightly Enlarged . . . 297
221 Tristellus 297
222 Hortuellus 298
223 Mellonella 298
224. Xylosteana with wings closed 299
225 Viridana . 300
226 Cristana—Enlarged . . 300
227 Lecheana . . . 300
228 Pruniana . . 300
229 Salicella . 301
230 Octomaculana—Enlarged . 301
231 Cirsiana—Enlarged . . 302
232 Pomonella . . 302
233 Zoegana—Enlarged . 302
234. Fagella . . . 303
235 [illegible] . 304
236 Padellus 304
237 Nervosa—Twice Natural Size 304
238 Geoffrella . 305
239 [illegible]—Enlarged 305
240 [illegible]—Enlarged . . 306
241 Aurella—Enlarged 307

PART I

STRUCTURE AND LIFE-HISTORY OF THE LEPIDOPTERA

CHAPTER I

GENERAL CHARACTERS

THE word *Lepidoptera*, which you see at the head of this page, is the name of the order of insects to which this volume is to be devoted. It is formed from two Greek words, one (*lepis*) signifying a *scale*, and the other (*pteron*) denoting a *wing*; and was applied by the great naturalist Linnæus to the scaly-winged insects popularly known as Butterflies and Moths.

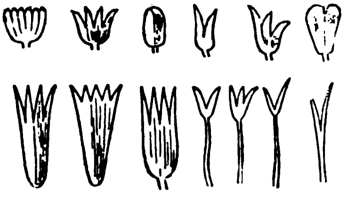

FIG. 1.—SCALES FROM THE WINGS OF BUTTERFLIES.

Every one of my readers has undoubtedly handled some of the interesting creatures of this group—having been led to do so either by the extreme beauty of their clothing, or, perhaps, from a murderous intent in order to protect his own garments from the ravages of a supposed marauder. A light mealy powder will probably have been observed afterwards on the fingers that have touched the victim's wings.

This powder, although it sometimes presents a beautiful glossy surface when spread over the skin, does not exhibit any definite form or structure without a more minute examination. Yet these are the scales that led the immortal naturalist to invent the somewhat long but useful term *Lepidoptera*.

The very next time the opportunity offers itself, dust off a little of the mealy powder with a small and very soft brush on to a strip of white paper or a slip of glass, and examine it with a powerful lens or the low power of a compound microscope. What a sight you will then behold! Each little particle of dust is a beautifully formed scale, stamped with a number of minute rounded projections, and often displaying the most gorgeous colours.

A great variety of designs and tints are often exhibited by the 'dust' from a single wing. Take, for instance, for your inspection, scales from the wing of one of our commonest insects, the Small Tortoiseshell Butterfly (Plate III), and you will be surprised at the pleasing contrasts. But when your curiosity leads you to deal with others in the same manner, the varied display of forms and colours is simply amazing.

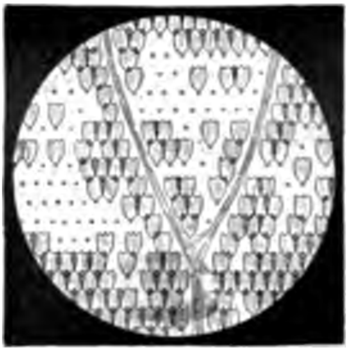

FIG. 2.—PORTION OF THE WING OF A BUTTERFLY FROM WHICH SOME OF THE SCALES HAVE BEEN REMOVED.

In order that we may learn still more of the structure of the wings of the *Lepidoptera*, we will examine a portion of one from which some of the scales have been removed, again bringing the lens or the microscope into our service. We now see that the scales are arranged in rows with great regularity on a thin and transparent membrane, which is supported by a system of branching rays. And the membrane itself, in parts which have been laid bare, is marked with regular rows of dots—the points at which the scales were originally attached by means of short hollow rods.

The framework that supports the thin membrane we have spoken of as consisting of a system of *rays*, but to these the terms *veins*, *nerves*, *nervures*, or *nervules* are more commonly applied by various naturalists. We cannot do better, however, than adhere to the name originally used, for the structures in question do not perform the functions of veins, though at first they contain blood, nor are they themselves parts of the nervous systems of the insects to which they belong.

The result of our examination of the wings of butterflies and moths has been to justify the application of the term *Lepidoptera*; but we must now study other equally important and interesting features of the structure of these insects. First, let us note the general form of the body.

A cursory glance at this portion of the creature's anatomy will show that it consists of three distinct and well-defined parts. In front there is the head, the size of which is somewhat small in proportion. Two very large eyes make up the greater portion of its bulk. It is remarkable, too, that butterflies possess eyes proportionately much larger than those of moths. Now, since butterflies always fly by day, and moths are, generally speaking, nocturnal insects, we might be led to suppose that the reverse of this arrangement would have suited the creatures better; for a small eye, we should think, would be able to collect sufficient light in the daytime to form a bright image, and a larger light-receiving area would be necessary during the darker hours for the same purpose. But it is evident that the sense of vision must depend on other conditions besides the *size* of the eye; and as these conditions are not understood in relation to the eyes of insects, any attempt at an explanation would be quite useless.

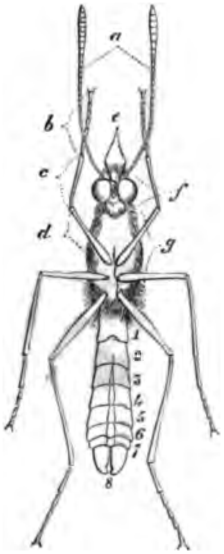

FIG. 3.—BODY OF A BUTTERFLY—UNDER SIDE.

1-7, segments of the abdomen; 8, anal extremity; *a*, antennæ; *b*, tarsus; *c*, tibia; *d*, femur; *e*, palpi; *f*, head; *g*, thorax.

The eye of a butterfly or moth is worthy of a closer examination, for it is a most beautiful and marvellous structure. The outer globular transparent membrane—the *cornea*—is divided into a large number of minute polygonal *facets*, each one of which admits light into a small conical compartment surrounded by a coloured membrane, and supplied with a fibre of the nerve of vision (the *optic* nerve). Hence the eye is often spoken of as *compound*.

If you look closely into the eyes of various butterflies and moths you will generally see a ground colour of grey, blue, brown, or black; but when viewed at certain angles in a strong light the most gorgeous hues of metallic brilliancy—gold, copper, and bronze—are to be observed. All such colours are due to the reflection of light from the colouring matter that lies between the numerous conical compartments.

A glance at the section of a compound eye will show you that all the little cones radiate from a common centre. And, as each little compartment is surrounded by opaque colouring matter, it is clear that perpendicular rays only are capable of penetrating to its base and exciting the nerve fibre that lies there. Thus each little division of a compound eye forms its own image of the object that happens to be exactly opposite its facet. But how many facets do we find in a single eye? Sometimes only a few hundreds, but sometimes as many as seventeen or eighteen thousand! We must not, however, conclude that the nature of the vision of butterflies and moths is necessarily very different from our own. We have two eyes, but the images formed by them are both blended, so that we do not see double. We can understand, therefore, that the thousands of images formed in a single eye may be blended together so as to form one continuous picture. Still there remains this difference: while in our own case the two images formed by the two eyes are practically the same, in the case of insects every one of the little conical tubes of a compound eye forms an image of an object that cannot possibly be formed by any one of the others. Thus, if the lepidopterous insect sees a continuous picture of its surroundings, such a picture is produced by the overlapping and blending, at their edges, of hundreds or thousands of distinct parts.

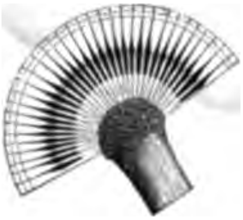
FIG. 4. SECTION OF THE EYE OF AN INSECT.

There is yet another interesting difference between the vision of these insects and that of ourselves. As already stated, our two eyes are both turned toward the same point at the same time. But look at the butterfly's eyes. Here are no movable eyeballs, and the two eyes, placed as they are at the *sides* of the head, are always turned in *opposite* directions. The corneæ, too, are very convex; and consequently the range of vision is vastly wider than ours. A boy is often easily surprised by a playmate who approaches him stealthily from behind, but did you ever try the same game with a butterfly? I have, many a time. After getting cautiously so near to a butterfly at rest as to be able to distinguish between its head and its hinder extremity, I have quietly circled round it so as to approach it from behind, being at the time under the impression that it wouldn't see me under those circumstances. But not the slightest advantage did I derive from this stratagem, for the position and construction of its eyes enabled it to see almost all ways at once.

In addition to the two compound eyes, the *Lepidoptera*, or at least most of them, are provided with two small simple eyes; but these are generally so hidden among the closely set hair that covers the head, that it is doubtful whether they are of much service as organs of vision.

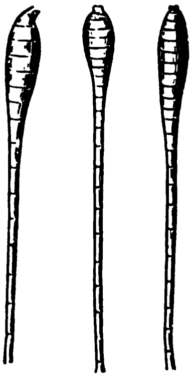

FIG. 5.—ANTENNÆ OF BUTTERFLIES.

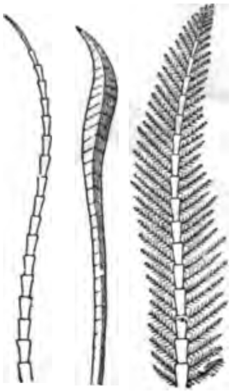

FIG. 6.—ANTENNÆ OF MOTHS.

The antennæ proceed from two points close to the upper borders of the eyes. They are jointed organs, and are of very different forms in the various species of *Lepidoptera*. They are generally long, slender, and clubbed at the extremity in butterflies, but exhibit several minor points of difference which we shall have to note later on. In moths the antennæ are sometimes long, slender, and pointed. Some are thick, and more or less prismatic in form; while others are slightly or deeply pectinated or comb-like. The antennæ of butterflies are always straight, or only slightly curved; and, although the insects can sway them bodily, they have no power to bend them, or to stow them away in any place of shelter. Moths, on the other hand, when at rest, are almost invariably found to have their antennæ snugly tucked under the wings, and brought so closely against the side of the head for this purpose that even the uncovered portion is often difficult to find.

There are two other prominent appendages belonging to the heads of the *Lepidoptera*. These are the *labial palpi* or feelers of the lips. They are generally easily seen, projecting forward on the under side of the head, sometimes so long and conspicuous as to give one the idea of a snout or long nose. The palpi are jointed—usually in three parts—are covered with scales, and often furnished with hairs or bristles.

If you watch a moth or butterfly when it is feeding on the sweet juices of a flower, or on some kind of artificial sweet with which you have provided it, you will observe its long trunk or *proboscis*, by which food is sucked up. This instrument is so long and slender that it seems almost impossible that it can be a tube through which a liquid freely passes. But a careful examination will show that this is the case. It is composed of two separate pieces—two half tubes, which, when closely applied to each other, form a very thin and flexible pipe, perfectly air-tight and adapted for suction. Sometimes you can see a butterfly or moth manipulating with its proboscis as if it required readjustment in some way or other. It has split the tube throughout its length, so that it now looks like two exceedingly fine hairs. Then, after a short time, the two halves are put together again, and immediately, as if by magic, become a single tube in which no kind of seam is to be observed without a powerful magnifier.

In order to observe the nature of such a wonderful arrangement we must have recourse to the aid of a good microscope. Thus assisted, we can see at once how the junction of the two sides of the proboscis is brought about so quickly and so perfectly. The inner edges of each half are very regularly fringed with lines of closely set hairs—so regular, in fact, are they, that they give one the idea of long yet minute beautifully formed combs. When the two parts are brought together, the hairs of two opposite edges interlock, those on one side exactly filling the spaces between those of the other.

The microscope also reveals another interesting fact, viz. that the proboscis is not a single tube, but, although so remarkably thin, is really a set of three distinct pipes, one lying on each side of the central one. It is said that the central tube only is used for sucking up the liquid food, and there seems to be some doubt as to the uses of the other two. Some naturalists are of opinion that the latter are air tubes, and are connected with the respiration of the insect; while others say that through these the insects eject a thin watery fluid with which to dissolve or dilute those sweetmeats that are not sufficiently liquid to be readily sucked up. But possibly both these opinions are correct, the proboscis serving all three of the purposes here named. The only observation of my own bearing on the subject is this. While a moth was feeding on a drop of syrup in a strong light, a powerful lens revealed drops of liquid, mingled with bubbles of air, passing alternately *up and down* the two lateral tubes of the proboscis. At the same time the upward current of syrup in the central tube was by no means steady and continuous.

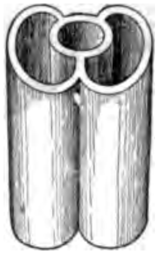
FIG. 7.—SECTION OF THE PROBOSCIS OF A BUTTERFLY.

When this organ is not in use, it is beautifully coiled into a close spiral which lies between the labial palpi. The length varies considerably in different insects, and consequently the number of turns in the spiral must differ also. Sometimes there are less than two turns, while some of the longer ones form spirals of from six to ten turns.

In concluding our brief account of the head of lepidopterous insects it is, I suppose, hardly necessary to add that there is no kind of chewing apparatus to be described; all the members of this order, at least in the perfect state, deriving the whole of the little nourishment they require entirely by suction through the proboscis or 'trunk.'

The second division of the body is the *thorax*. This is much larger than the head, and consists of three ring-like segments, joined one behind the other so intimately that the lines of junction are hardly visible, even after the thick clothing of fine hair has been brushed off. Behind the thorax is the abdomen, which is composed of several segments, the junctions between the rings often being most distinct.

From the sides of the thorax proceed the two pairs of wings, the general structure of which we have already to a certain extent examined. But when we are a little farther advanced in our insect studies, we shall have to become acquainted with detailed descriptions given as aids to the identification of species. Now, such descriptions cannot be satisfactory, either to the one who gives or to him who receives, unless expressed in such definite terms as render a misunderstanding impossible. A botanist cannot give an accurate and concise description of a flower without the use of certain names and expressions which have gradually become an almost necessary part of his vocabulary; neither can an entomologist give a really useful, and, at the same time, a *succinct* description of an insect unless he is acquainted with the names of its parts. Therefore, seeing that we distinguish the various species of butterflies and moths *mainly* by the arrangement and colour of the markings of their wings, it is really necessary that we should know the names of the different parts of these organs. For this reason I have inserted drawings of a fore and of a hind wing of a butterfly, together with the names of the various parts of the wings, and also the names of the principal rays or *nervures*. Yet I would not advise any young entomologist to attempt to commit to memory all the names given. Rather use the diagram for reference when occasion requires, more particularly when you have an insect in your possession that you desire to study. In ordinary descriptions of butterflies and moths the names of the *nervures* are not so generally used as those of the *parts* of the wing. Consequently it is exceedingly useful to know what is meant by the terms *base*, *costal margin*, *apex*, *hind margin*, *anal angle*, *inner margin*, *discoidal cell* &c. as applied to the wing.

The two pairs of wings are attached to the second and third segments of the thorax; but of the *three* pairs of legs, which we have next to consider, one pair arises from each of the three segments. The arrangement of these limbs is well shown in the sketch on page 3, as are also the names of the different parts of the limb, the latter being given for reference by the reader when the need arises.

All insects, in their perfect state, we are told, have three pairs of legs; but if you examine the under surface of certain butterflies, such as the Marbled White, or any of the Vanessas, Browns, or Heaths, it is quite likely that you will raise objection to such a statement; for in these you may possibly see only four legs. But this is the result of a too cursory observation. Look a little more closely at your specimen, and you will see a pair of smaller legs folded up under the fore part of the thorax. By means of a blunt needle you can straighten out these limbs, and then the difference in length to be observed between them and the other four is very striking indeed. They are also thinner than the middle and hind legs; and, unlike these, are not provided with claws.

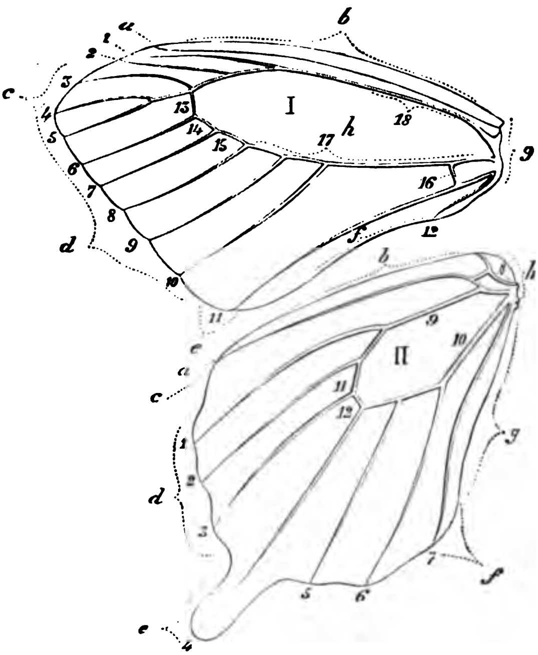

FIG. 8.—DIAGRAM OF THE WINGS OF A BUTTERFLY.

I. *Fore wing.*—1–5, subcostal nervules; 6, 7, discoidal nervules; 8–10, median nervules; 11, submedian nervure; 12, internal nervure; 13–15, disco-cellular nervules; 16, interno-median nervule; 17, median nervure; 18, subcostal nervure; *a*, costal nervure; *b*, costa or anterior margin; *c*, apex or anterior angle; *d*, posterior or hind margin; *e*, posterior or anal angle; *f*, interior or inner margin; *g*, base; *h*, discoidal cell.

II. *Hind wing.*—1, 2, subcostal nervules; 3, discoidal nervule; 4–6, median nervules; 7, submedian nervure; 8, precostal nervure; 9, subcostal nervure; 10, median nervure; 11, 12, disco-cellular nervules; *a*, costal nervure; *b*, costa or anterior margin; *c*, apex or anterior angle; *d*, hind margin; *e*, tail or caudal appendage; *f*, anal angle; *g*, abdominal or inner margin; *h*, base.

These imperfectly developed legs are, of course, quite useless as far as walking is concerned; indeed, it is extremely doubtful as to whether they are of any service whatever to the owner. On one occasion, however, while watching a Peacock Butterfly apparently engaged in cleaning its divided proboscis, I observed that this organ was frequently passed under the thorax, and that the front pair of legs were pressed against it on each side, while it was being drawn outward between them. It is probable, therefore, that these limbs constitute a pair of brushes by means of which the fine grooves of the divided trunk are cleared of any solid or sticky matter that may lodge therein. It is certain that moths, and those butterflies that possess six *equal* legs, use the front pair for this same purpose. The former, also, employ them for brushing their antennæ, which seem to be, by the way, particularly sensitive to different kinds of irritation.

It is a well-known fact that tobacco smoke has a powerful influence on certain small insects; and even though it can hardly be regarded as a perfect all-round insecticide, it is certainly more or less objectionable to the larger and hardier species. A short time since, while watching a number of newly emerged moths of the *Sphinx* group, and at the same time enjoying the solace afforded by the luxurious weed, a puff of the smoke was accidentally allowed to play into the box in which my pets were for the time imprisoned. Immediately they rubbed their front legs vigorously over the antennæ, as if to remove the obnoxious irritant that had thus intruded on their presence. Similar observations have led many naturalists to suppose that the antennæ are the seat of various senses, such as those of touch, hearing, and smell. Seeing that insects do not, as far as we know, possess special organs for all the five senses which we enjoy (and it is interesting to note here that some insects certainly experience other sensations which are quite beyond our ken), we can quite understand the common tendency to locate the seats of certain of the senses in such easily affected parts as the antennæ. But little, I believe, has been definitely proved save that the antennæ are sensitive to touch and to irritants generally.

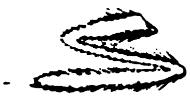
FIG. 9.—THE UNDEVELOPED FORE LEG OF A BUTTERFLY.

While speaking of the senses of insects, I cannot refrain from mentioning a most remarkable example of a peculiar sensitiveness that has been observed in certain moths of the family *Bombyces* (page 217), notably the Oak Eggar, the Emperor, and the Kentish Glory. Take a newly emerged female of either of these species, shut her up in a small box, conceal the box in your pocket, and then walk about in some country spot known to you as being one of the haunts of that species of moth. Then, if any of the males of the same species happen to be in the neighbourhood, they will settle or hover about close to the female which, although still concealed and quite out of their reach, has attracted them to the spot.

What a marvellously acute sense this must be, that thus enables the insects to scent out, as it were, their mates at considerable distances, even when doubly surrounded by a wooden box and the material of a coat pocket! You would naturally expect that entomologists have turned this wonderful power to account. Many a box has been filled with the beautiful Kentish Glories of the male kind, who had been led into the snare by the attractions of a virgin Glory that they were never to behold. Many an Emperor has also been decoyed from his throne to the place of his execution, beguiled by the imaginary charms of an Empress on whom he was never to cast one passing glance. And these and other similar captures have been made in places where, without the employment of the innocent enchantress, perhaps not a single male could have been found, even after the most diligent search.

Speaking of this surprising sense, I am again tempted to revert to the antennæ; for it is a remarkable fact that the males of those species of moths which exhibit the power of thus searching out their mates, are just those that are also remarkable for their very broad and deeply pectinated antennæ—a fact that has led to the supposition that the power in question is located in the antennæ, and is also proportional to the amount of surface displayed by these organs.

Up to the present time we have been considering the butterfly and moth in their perfect forms, but everybody knows that the former is not *always* a butterfly, nor is the latter always a moth; but that they both pass through certain preparatory stages before they attain their final winged state.

We shall now notice briefly what these earlier stages are, leaving the detailed descriptions of each for the following chapters.

The life of the perfect butterfly or moth is of very short duration, often only a few days, nearly the whole of its existence having been spent in preparing itself for the brief term to be enjoyed

. . . . in fields of light,
And where the flowers of Paradise unfold.

It may be interesting to consider of what use the metamorphoses of insects are, and to what extent these metamorphoses render them fit for the work they have to do.

It is certain that the chief work of insects, taken as a whole, is to remove from the earth the excess of animal and vegetable matter. If they are to do this work effectually, it is clear that they must be very voracious feeders, and also be capable of multiplying their species prodigiously. Now each of these powers requires the special development of a certain set of organs, and an abnormal development of one set must necessarily be produced at the expense of the other. Hence we find insects existing in two distinct stages, with or without an intermediate quiescent state, during the first of which the digestive apparatus is enormously developed, while the reproductive organs occupy but very little space; then, during the other stage, the digestive apparatus is of the simplest possible description, and the organs of reproduction are in a perfect state of development.

Allowing, then, that the chief work of the insect is the removal of surplus organic matter, we can see that a large share of its life should be spent in the larval or grub stage, and that the perfect state *need* not occupy any more time than is necessary for the fertilisation of the eggs that almost completely fill the body of the female at the time of her emergence from the chrysalis shell.

Many insects undergo their metamorphoses by slow degrees, but the *Lepidoptera*, after existing for some considerable period without any important visible change in structure, pass by a rapid transition into the next state. Thus, a caterpillar, that has not altered in general form for several weeks, changes into a chrysalis within the course of a few days; and again, after a period of quiescence that may extend throughout the whole of the colder months, becomes a perfect butterfly or moth within twenty minutes of the moment of its emergence.

But this suddenness is more apparent than real, as may easily be proved by internal examinations of the insect at various stages of growth; showing that we are led astray by the rapidity of *external* changes — the mere *moultings* or castings of the skin — while the gradual transformations proceeding within are not so readily observed.

We have already said that the life of the perfect butterfly or moth is short. A few days after emergence from the chrysalis case, the female deposits her eggs on the leaves or stems of the plant that is to sustain the larvæ. Her work is now accomplished, and the few days more allowed her are spent in frolicking among the flowers, and sucking the sweet juices they provide. But males and females alike—bedecked with the most gorgeous colours and overflowing with sportive mirth when first they take to the wing—soon show the symptoms of a fast approaching end. Their colours begin to fade, and the beauty-making scales of the wings gradually disappear through friction against the petals of hundreds of flowers visited and the merry dances with scores and scores of playful companions. At last, one bright afternoon, while the sun is still high in the heavens, a butterfly, more weary than usual, with heavy and laborious flight, seeks a place of rest for the approaching night. Here, on a waving stalk, it is soon lulled to sleep by a gentle breeze.

Next morning, a few hours before noon, the blazing sun calls it out for its usual frolics. But its body now seems too heavy to be supported by the feeble and ragged wings, and, after one or two weak attempts at play, incited by the approach of a younger and merrier companion, it settles down in its final resting place. On the following morning a dead butterfly is seen, still clinging by its claws to a swinging stem, from which it is eventually thrown during a storm.

The tale of the perfect moth is very similar to the above, except that it is generally summoned to activity by the approach of darkness.

We see, then, that butterflies and moths exhibit none of that quality which we term parental affection. Their duty ends with the deposition of the eggs, and the parents are dead before the young larvæ have penetrated the shell that surrounds them.

Yet it is wonderful to see how unmistakably the females generally lay their eggs on the very plants that provide the necessary food for their progeny, as if they were not only conscious of and careful concerning the exact requirements of their offspring, but also possessed such a knowledge of botanical science as enabled them to discriminate between the plant required and all others.

Has the perfect insect any selfish motive in this apparently careful selection of a plant on which to lay its eggs? Does the female herself derive any benefit from the particular plant chosen for this purpose? In most cases, certainly not. For it often happens that the blossom of this plant is not by any means one of those that supply the sweets which insects love, and still more frequently does it occur that the eggs are deposited either before the flowers have appeared or after they have faded.

Neither can we easily impute to the insect an acquired knowledge of the nature and wants of her offspring, or an acquaintance with botany sufficient to enable her to distinguish plant forms. Our only solution of the problem (which is really no solution at all) is to attribute the whole thing to that inexplicable quality which we are pleased to term *natural instinct.* It is to be observed, however, that it is not *all* butterflies and moths that display this unerring power. Some few seem to deposit their eggs indiscriminately on all kinds of herbage. But, I believe, the larvæ of these species are generally grass feeders, and would seldom have to travel far from any spot without meeting with an acceptable morsel.

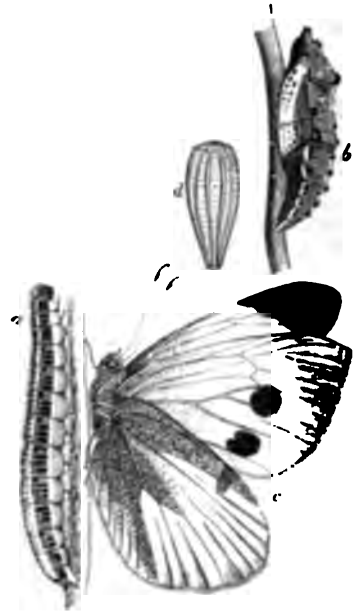

FIG. 10. THE FOUR STAGES OF THE LARGE WHITE BUTTERFLY (*Pieris Brassicæ*).

a, larva; *b*, pupa; *c*, imago; *d*, egg.

But we must now pass on to a brief consideration of the other stages of the insect's existence. After a time, varying from a few days to several months, the young caterpillars or larvæ make their appearance. They soon commence feeding in right earnest. Their period of existence in this state varies from a few weeks to several months, and even, in some cases, to years. During this time their growth is generally very rapid, and they undergo a series of *moults* or changes of skin, of which we shall have more to say in a future chapter. Then, when fully grown, they prepare for an apparently quiescent form, which we speak of as the *pupa* or chrysalis, and in which they again spend a very variable period, extending over a few days, weeks, or months. Now, inclosed in a protective case, each pupa is undergoing a remarkable change. Some of its old organs are disappearing, and others are developing; and, after all the parts of the future insect have been developed as far as its narrow shell will permit, it bursts forth into the world as a perfect insect or *imago*.

Its wings at first are small, shapeless, and crumpled in a most unsightly fashion; but it is not long before they assume their full size, beautiful form, and gorgeous colouring. Then, in about another hour or two, the wings, at first soft and flaccid, have become sufficiently dry and stiff to bear their owner rapidly through the air.

We have thus observed some of the more striking features in the structure of the butterfly and moth in its most perfect state; and alluded in a very brief manner to the various stages through which these creatures must necessarily pass before finally reaching this stage. But now we must study these earlier stages more closely, and watch the insects during the marvellous transitions they are destined to undergo. This we shall do in the following chapters.

CHAPTER II

THE EGG

I SUPPOSE you are all acquainted with the general structure of the hen's egg, having dissected several, in your own way, many a time.

Its outer covering, which you speak of as the 'shell,' you have observed is hard and brittle. It is composed of a *calcareous* or limy substance, known chemically as *carbonate of lime*. If you put some pieces of it into an egg cup, and throw over them a little vinegar or any other liquid acid, you will see them gradually dissolve away, and small bubbles of carbonic acid gas will rise into the air. Then again, if you take a long and narrow strip of the shell, and hold one end of it in a gas or lamp flame, after a short time that end will become softer, and will glow brightly in the flame, for it is converted into lime—the same substance that is used by the builders for making their mortar and the bright glow is really a miniature *lime light*, such as is always produced when a piece of lime is made intensely hot.

Just inside this shell you have seen a thin membrane or skin that is easily peeled off the substance of the egg itself. Next to this comes the 'white' of the egg, which is really colourless while liquid, but turns white and more or less solid in the cooking. Last of all, in the centre of this, you have noticed the oval yellow mass that is termed the 'yoke' or 'yolk,' and which contains the embryo of the future chick.

Now if you imagine this egg to be reduced in size till two or three dozen of them would be required to form a single line about one inch long, the outer calcareous shell to be entirely removed, the skin or membrane to be converted into a firmer substance of a horny nature, and, finally, the yolk to be absent and the whole internal space to be filled with the 'white,' you will then have some idea of the nature of the egg of a butterfly or moth.

To put the matter more briefly, then, we will say that the eggs of these insects are simply little liquid masses, usually of a colourless substance, surrounded by a horny and flexible covering.

Such a description may certainly give you some idea of the nature of the eggs of insects, but no amount of book reading will serve the purpose so well or be so pleasant as the examination of the eggs themselves. During the summer months very little difficulty will be experienced in finding some eggs in your own garden. Turn over some leaves and examine their under surfaces, choosing especially those plants which show, by their partially eaten leaves, that they are favourites with the insect world. Or you may amuse yourself by catching a number of butterflies—common 'Whites' are as good for the purpose as any—and temporarily confine them in a wooden or cardboard box, containing a number of leaves from various plants, and covered with gauze. In this way you are sure to obtain a few females that have not yet laid all their eggs; and if you watch your prisoners you will soon see them carefully depositing the eggs on the under surfaces of leaves, bending their abdomens round the edges if there is not sufficient room to get themselves completely under. And then, when you are satisfied with the number of eggs thus obtained for your examination, you can have the pleasure of seeing all your liberated captives flying joyfully in the free air.

In giving these simple instructions I have assumed that the reader has not yet learnt any of the characters by which female butterflies are to be distinguished from their lords and masters; but I hope that he will know soon, at least with regard to a good many species, from which individuals he may most reasonably expect to obtain eggs, and so be able to avoid the imprisonment, even though only temporary, of insects which cannot satisfy his wants.

Again, it is not necessary, after all, that butterflies should be captured for the purpose of obtaining eggs. Watch them as they hover about among your flowers. Some, you will observe, are intent on nothing but idle frolicking; and you may conclude at once that *these* have no immediate duty to perform. Others are flying without hesitation from flower to flower, gorging themselves with the sweets of life: these are not the objects of your search. But you will descry certain others, flying round about the beds and borders with a steadier and more matronly air, taking little or no notice of their more frivolous companions, and paying not the slightest heed to the bright nectar-producing cups of the numerous flowers. These are seriously engaged with family affairs only. Watch one of them carefully, and as soon as she has settled herself on a leaf, walk steadily towards her till you are near enough to observe her movements. She will not move unless you approach too closely, for, like busy folk generally, she has no time to worry about petty annoyances. You will now actually witness the deposition of the eggs exactly as carried on in the perfect freedom of nature; and the eggs themselves may be taken either for examination or for the rearing of the caterpillars.

Some species of *Lepidoptera* lay some hundreds of eggs, and it is seldom that the number laid by one female is much below a hundred.

As already stated, the under surfaces of leaves are generally chosen for the deposit of eggs, but a few of the insects we are considering always select the upper surface for this purpose. Thus the Puss Moth (page 285), and two or three others resembling it, though much smaller, known as the Kittens (page 284), invariably lay them on the upper surface. And this is the more surprising since the eggs of these moths are brown or black, and consequently so conspicuous on the green leaves as to be in danger of being sighted by the numerous enemies of insects.

The Hairstreak Butterflies (page 188) afford another exception to the general rule, for their eggs are deposited on the *bark* of the trees and shrubs (birch, sloe, elm, oak, and bramble) on which their larvæ feed.

At the moment each egg is laid it is covered with a liquid sticky substance, so that it is immediately glued to the leaf or stem as soon as it is deposited. The sticky substance soon dries, causing the egg to be so firmly fastened in its place that it is often impossible to force it off without destroying it completely.

Some of the *Lepidoptera* deposit their eggs singly, or in small irregular clusters; but by far the larger number set them very regularly side by side, in so compact a mass that it would be impossible to place them on a smaller area without piling one on top of another. This is not accomplished with the aid of the sight, for the insect performing her task with such precision often has her head on one side of a leaf or stem while arranging her eggs on the other. If you take the trouble to watch her, you will see that she carefully *feels* out a place for each egg by means of the tip of her abdomen immediately before laying it.

The eggs are laid by moths and butterflies at various seasons of the year. In some cases they are deposited early in the spring, even before the buds of the food plants have burst; and the young larvæ, hatched a few weeks later, commence to feed on the young and tender leaves. Then, throughout the late spring, the whole of the summer and autumn, and even till the winter frosts set in, the eggs of various species are being laid.

Those deposited during the warm weather are often hatched in a few days, but those laid toward the autumn remain unchanged until the following spring.

In this latter case the frosts of the most severe winter are not capable of destroying the vitality of the eggs. In many instances the perfect insect or the larva would be killed by the temperature of an average winter day, but the vitality of the eggs is such that they have been subjected to a temperature, artificially produced, of fifty degrees below the freezing point, and even after this the young larvæ walked out of their cradles at their appointed time just as if nothing unusual had occurred.

Experiments have also been performed on the eggs with a view of determining how far their vitality is influenced by high temperatures. We know that the scorching midsummer sun has no destructive influence on them, but these experiments prove that they are not influenced by a temperature only twenty degrees below the boiling point—actually a considerably higher temperature than is *necessary* to properly cook a hen's egg.

Let us now examine a number of eggs of different species, that we may note some of the many variations in form and colour.

With regard to colour, we have already observed that the eggs of a few species are black; but more commonly they are much lighter—pearly white, green, yellow, and grey being of frequent occurrence.

The great variety of form, however, will provide a vast amount of enjoyment to anyone who possesses a good magnifying lens or a small compound microscope. Some are globular, others oval; while many others represent cups, basins, and domes. Then we have miniature vases, flasks, bottles with short necks, and numerous figures that must remind a juvenile admirer of the sweet cakes and ornamental jellies that have so often gladdened his longing eyes.

Again, the beautifully sculptured surfaces of a large number are even more striking than their general shapes. Some are regularly ribbed from top to bottom with parallel or radiating ridges, and at the same time marked with delicate transverse lines. Others are beautifully pitted or honeycombed, some ornamented with the most faithful representation of fine wicker-work, while a few are provided with a cap, more or less ornamental, that is raised by the young larva when about to see the world for the first time. A few of these beautiful forms are here illustrated and named, and another has already appeared on page 14, but an enthusiastic young naturalist may easily secure a variety of others for his own examination.

It may be surmised from the accompanying illustrations that the form of the egg is always the same for any one species. This is really the case, and consequently an experienced entomologist can often decide on the name of the butterfly or moth that deposited a cluster of eggs he happens to find in his rambles and searchings; but in such decisions he is always greatly assisted by a knowledge of the food plants of the various insects, and sometimes also by the manner in which the eggs are arranged.

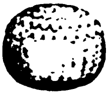
Fig. 11.—Egg of the Meadow Brown Butterfly.

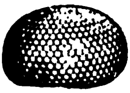
Fig. 12.—Egg of the Speckled Wood Butterfly.

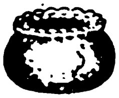
Fig. 13.—Egg of the Vapourer Moth.

We have seen that the period during which the *Lepidoptera* remain in the egg stage is very variable, and depends largely on the season in which they were laid; but it is often possible to tell when to expect the young larvæ by certain changes which take place in the appearance of the egg. As the horny covering of the egg is transparent, the gradual development of the caterpillar from the clear fluid can be watched to a certain extent; but if you have a microscope, and would like to witness this development to perfection, proceed as follows.

Arrange that some butterflies and moths shall lay their eggs on strips of glass of convenient dimensions for microscopic work—three inches long by one wide is the usual size for this kind of work. This is easily accomplished by placing a proper selection of female insects in a rather small box temporarily lined with such 'slips.' When a few eggs have thus been secured, all you have to do is to examine them at intervals with your microscope, always using the reflector so as to direct a strong light *through* the eggs from below.

But even without such an arrangement some interesting changes are to be observed. As a rule, the colour of the egg turns darker as the time for the arrival of the infant larva approaches, and you will often be able to see a little brown or black head moving slightly within the 'shell.' You may know then that the hatching is close at hand, and the movements of the tiny creature are well worth careful watching. Soon a small hole appears in the side of the case, and a little green or dark cap begins to show itself. Then, with a magnifier of some kind, you may see a pair of tiny jaws, working horizontally, and not with an up-and-down motion like our own, gradually gnawing away at the cradle, till at last the little creature is perfectly free to ramble in search of food.

Strange to say, the young larva does not waste a particle of the horny substance that must necessarily be removed in securing its liberty, but devours it with an apparent relish. Indeed, it appreciates the flavour of this viand so highly that it often disposes of the whole of its little home, with the exception of the small circular patch by which it was cemented to the plant. When the whole brood have thus dispensed with their empty cradles, there remains on the stem or leaf a glittering patch of little pearly plates.

After the performance of this feat the young caterpillar starts off in life on its own account with as much briskness and confidence as if it had previously spent a term in the world under the same conditions; but we must reserve an account of its doings and sufferings for our next chapter.

CHAPTER III

THE LARVA

In almost every case the young caterpillar, on quitting the 'shell' of the egg, finds itself standing on and surrounded by its natural food, and immediately commences to do justice to the abundant supply. It will either nibble away at the surface of the leaf, removing the soft cellular substance, so that the leaf exhibits a number of semi-transparent patches when held up to the light, or it will make straight for the edge, and, closing its horizontal jaws on either side, bite the leaf completely through, and thus remove a small piece each time.

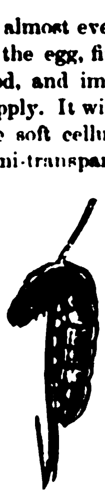
FIG. 14. THE CATERPILLAR OF THE CLOUDED YELLOW BUTTERFLY.

Several naturalists have amused themselves by performing experiments and making calculations on the efficiency of the masticating and digesting powers of the caterpillar. The illustrious Réaumur, for example, proved that some of the cabbage eaters disposed of more than twice their own weight of food in twenty-four hours, during which time their weight increased one-tenth. Let us see what this would be equivalent to in human beings: A man weighing eleven stone would devour over three hundred pounds of food in a day, and at the end of that day weigh about fifteen pounds more than he did at the beginning!

So the young caterpillar eats, and rests, and grows, till, while still young, its body has become too large for the already tightened skin. It evidently feels very uncomfortable. Its appetite fails, and it remains for a time perfectly quiet in one spot, having previously spun a little carpet of silk to form a firm foothold during its temporary indisposition. Its colours have also become dingy, and anyone, not understanding the character of its growth, might easily be led to suppose that the poor creature was displaying the earlier symptoms of a serious and perhaps fatal illness.

But soon an encouraging symptom is observed. The caterpillar begins to get restless. Its front segments are turned alternately right and left, and are also made to swell out much beyond their normal size. Then in a very short time—often less than a minute from the first appearances of restlessness—the skin, which has become somewhat dry and brittle, splits along the back over the second, third and fourth segments, revealing a new and bright coat beneath. The caterpillar continues its struggles and, in addition to the previous movements, causes the swelling to move backward along the body. This, acting like a wedge, causes the rent in the old coat to extend in that direction.

The caterpillar now draws its head backward, and, with a few convulsive struggles, pulls the front segments out of their old skin, and passes its head out of the rent in the back. With its foremost segments thus rendered perfectly free, it walks straight out of the old garment, which is left still fixed by the legs to the silken carpet.

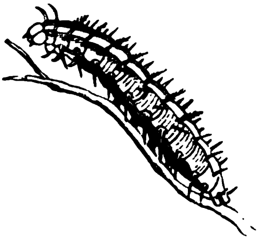

Fig. 15.—The Caterpillar of the Dark Green Fritillary Butterfly.

The larva, although now fresh and smart in its appearance, is exhausted by these struggles and its prolonged fast. The new skin, moreover, is very soft and tender, even to the cases of the head and legs, which are normally very hard. But a short period of rest suffices to dry its skin and sharpen its appetite, and then it eats more vigorously than ever.

We will now leave the caterpillar for a moment while we look at its cast-off clothes. They are still clinging to a stem so firmly that they can scarcely be removed without injury. The hard shell that covered the head and jaws is perfect in form, and so are the claws and cases of the legs. All the hairs or spines that happened to adorn the previous owner still retain their positions; and the whole skin, although always more or less shrivelled, is sometimes so slightly altered in form that it might be mistaken for a living caterpillar if not closely examined.

But this is not all. For, according to the accounts of some authoritative observers, the lining of the digestive organs, which is really a continuation of the outer skin, is cast off (or rather cast *out)* at the same time, as are also the linings of the larger breathing tubes which are presently to be described.

We have seen that some caterpillars, on quitting their egg cases (which may really be regarded as the first moult), make their first meal of the old covering. So also some of them, in their future moultings, exhibit an apparently useless economy (seeing that they are surrounded by an abundance of their natural vegetable diet) by devouring their old coats! In the face of this fact we can hardly describe them as strict vegetarians.

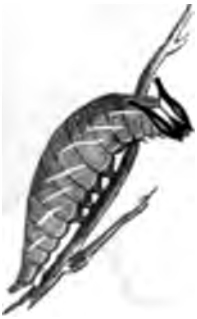

Fig. 16.—The Caterpillar of the Purple Emperor Butterfly.

Having thus passed through its first hardship, the caterpillar has by no means seen the end of the troubles and dangers that beset it; for, during its existence in the larval state, it has to go through a series of three, four, five, or even six moults, all of which are periods of considerable inconvenience, and perhaps even pain, and frequently prove fatal. And it is by no means an uncommon thing to meet with the lifeless body of an unfortunate individual who, as shown by its shabby appearance and the silken carpet under its feet, has evidently fallen a victim to the dangerous process of ridding itself of an old garment.

But this is only one of the many dangers to which caterpillars are exposed. Throughout every hour of the day the sharp and hungry eyes of the numerous insect-eating birds are searching the leaves for such delicacies to satisfy the wants of themselves and their broods. The lively little lizards, too, during the sunny hours are busily engaged in searching them out among the foliage of heaths and banks.

Very formidable enemies also exist in the form of Ichneumon and other species of flies, which pierce the skins of caterpillars with their sharp *ovipositors*, and lay their eggs within the bodies of the unfortunate victims. As soon as the young larvæ are hatched from these eggs, they commence feeding on the fatty substance stored beneath the caterpillar's skin. They carefully avoid, at first, attacking the vital organs of their host's body, and in this way secure for themselves a more lasting supply of fresh food.

When the fatty substance is nearly all gone, they eat their way into the more important structures, of course steadily growing all the time; and so, even though the body of the caterpillar is rapidly diminishing, the total bulk shows often no very appreciable decrease in size. When the larvæ of the flies are fully fed, they either change to the pupa within the carcase of their host, or eat their way out of its body and construct for themselves a cocoon in which to undergo the transformation.

As for the caterpillar itself, it sometimes dies before the time for its metamorphosis has arrived; but it often changes to the chrysalis before its fate is sealed. In this latter case, a number of flies, having undergone their final transformation within the chrysalis shell (there being but little else than shell remaining of the victim's body), break forth from the remains of the carcase somewhere about the time at which the butterfly or moth should have appeared.

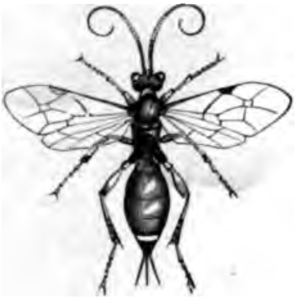

FIG. 17. — AN ICHNEUMON FLY (*Cryptus Migrator*).

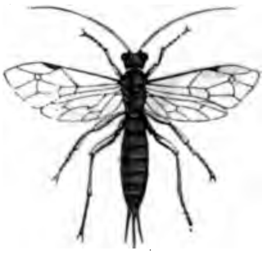

FIG. 18. – ANOTHER ICHNEUMON FLY (*Pimpla Instigator*).

Caterpillars have also their nocturnal enemies and devourers, among which may be mentioned frogs, toads, newts, and insect-eating mammals.

We must now learn something of the structure of caterpillars; and then become acquainted with their habits, and the change to the chrysalis or pupa.

Take a caterpillar from your garden, preferably a full-grown one of a rather large species, that is not very densely covered with hair, and examine it carefully as we note the main points in its structure. The first point that strikes our notice is the division of its body into segments or rings, separated from each other by a more or less distinct line or slight constriction of the body.

There are thirteen of these segments, reckoning, as is usual, the head as the first.

The head is usually very hard, and often of a much darker colour than the rest of the body. It is also frequently divided into two lobes by a couple of oblique lines, between which the parts of the mouth are situated. The two powerful horizontal jaws, to which we have already referred, are very hard and sharp, and curved like a sickle, and therefore splendidly adapted for biting from the edges of leaves. The head is also provided with a pair of antennæ, usually very short and inconspicuous and protected by a horny covering.

Unlike the perfect insect, the caterpillar has no large compound eyes, but twelve very small simple eyes, situated on the cheeks, very near the mouth — six on each side.

If you examine them with a magnifier, you see that each one is provided with a small and very convex lens—a lens of very *short focus*, such as would be used for the examination of small objects held very near to the eye. From this arrangement we should be inclined to conclude that the caterpillar can see only those objects that are close to its mouth; and this idea is strengthened if you place one in a box containing a number of leaves, one of which is that of its own food plant. It will wander about the box, apparently looking at every part of every leaf it passes, after the manner of a very short-sighted individual, and never taking a general look round. A butterfly or a moth can see a flower in the distance, for it flies unhesitatingly from one to another in the straightest and shortest path, but if you place a caterpillar in the centre of a ring composed of a leaf of its food plant and nine others from other plants, the chances are (nine to one) that it will *not* walk towards what it would like to have.

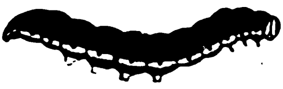

FIG. 19.—THE CATERPILLAR OF THE ANGLE SHADES MOTH (*Meticulosa*).

Again, the eyes are situated on the *lower* part of the cheek, directed slightly downward, and are therefore adapted for seeing what is just under its jaws as it walks along. Had we no knowledge whatever of the caterpillar's twelve little eyes, we should probably have thought that it sought out its food by some sense other than that of vision.

Another important and interesting feature of the head is the silk-spinning apparatus, situated under cover of the lower lip. This consists of two tubular glands, corresponding to our own salivary glands, the special purpose of which is to secrete a viscid fluid that solidifies on exposure to air. The opening by which the fluid escapes is so situated that the caterpillar can easily apply it to the surface of any object over which it is walking, and then, by drawing or turning away its head, cause a silken fibre to be produced.

Some caterpillars make use of this spinning apparatus only on a few special occasions, but others, more especially some of the smaller species, seem to have it always in use, so that if at any time you suddenly start them into the air by giving a smart tap to the plant or twig on which they rest, they invariably fall slowly on the end of a growing web, the spinning of which they stop as soon as they consider they have fallen far enough. Sometimes, as you are walking through a wood, you will see hundreds, nay, thousands of little caterpillars thus suspended, swinging gently in the breeze. Not long since, after only a few minutes' walk among the trees of Epping Forest, I found I was decorated with several dozens of these swingers with which I had come into collision—in this case consisting chiefly of the larvæ of the Green Tortrix Moth (*Tortrix viridana*).

Now let us examine the caterpillar's limbs. Attached to each of the second, third, and fourth segments is a pair of true walking legs, corresponding with those of the perfect insect. These are covered with a hard and shining substance, and are also each provided with a hook. The fifth and sixth segments have no limbs at all, nor have the eleventh and twelfth, but some or all of the others (seventh, eighth, ninth, tenth, and thirteenth) are furnished with a pair of claspers which we shall presently describe.

First, as regards the number of claspers, it will be seen from what has just been said that this is not always the same. Some caterpillars possess five pairs, thus making up the total number of walking appendages to sixteen. In fact, we must regard this as the *usual* number. But there are at least a few hundred exceptions to the rule. Many of the *Bombyces* (page 217), for example, have only four pairs of claspers; and in others of the same group the fifth pair is present, but only partially developed, and quite useless for walking.

Look at the peculiar caterpillar of the Lobster Moth (fig. 23) - a creature that differs from most other caterpillars not only in its claspers, but in many other respects too. Observe its long and slender legs, its humped middle segments, and its upturned hindermost segment, of enormous size and mounted with a pair of clubbed 'horns.' This last segment, you will observe, has no claspers.

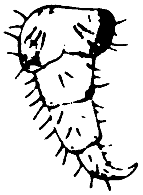

Fig. 20. - Walking Leg of a Caterpillar.

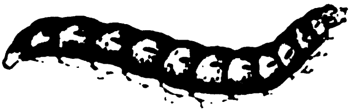

Fig. 21. Larva of the Yellow Underwing Moth (*Pronuba*).

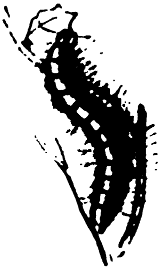

Fig. 22. Larva of the Crimson Speckled Moth (*Pulchella*).

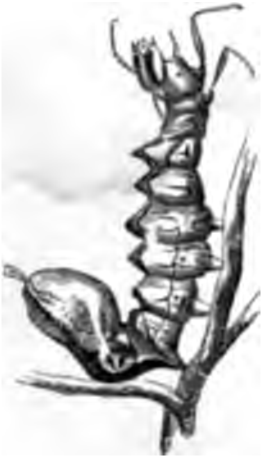

Fig. 23. - Larva of the Lobster Moth (*Fagi*).

Another allied caterpillar is that of the Iron Prominent Moth (fig. 24). This one also has humped segments, and the claspers of the thirteenth segment are imperfectly developed.

A large number of other exceptions to the general rule are to be found in the caterpillars of the Geometer Moths (page 268), one of which is here represented. These have generally only two pairs of claspers, one pair on each of the tenth and last segments, so that there is a distance equal to the combined length of six segments between the hindermost true leg and the first pair of claspers. But even among the Geometers there are variations to be observed in the number of claspers, and some of these will be pointed out in our brief descriptions of the commoner species.

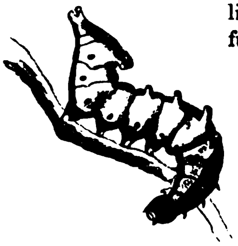

Fig. 24.—Caterpillar of the Iron Prominent Moth (*Dromedarius*).

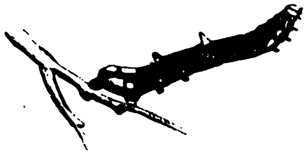

Fig. 25.—Larva of the Brimstone Moth (*Luteolata*).

These limbs which we have been calling claspers are known by several other names. Thus they are termed 'pro-legs,' 'temporary legs,' 'false legs,' and 'abdominal legs;' but if you watch a caterpillar as it walks up a stalk or along the edge of a leaf, you will certainly agree that the term 'clasper' is everything that could be desired. But why not call them legs, seeing that they are used in walking? The reason is that they differ in many respects from the three foremost pairs of limbs as regards structure, persistency, and function. The true legs, as we have called them, continue to exist, though concealed, in the chrysalis state, and again appear, far more perfectly developed, in the butterfly or moth, but the claspers are no more to be seen after the caterpillar has passed into the quiescent stage. We have noticed, too, that the true legs are pointed and clawed, also that they are protected by a hard and horny covering; but examine a large caterpillar, holding it between the fingers and thumb with its under side uppermost, and you will soon see that the claspers are not at all hard, but soft and fleshy; not pointed, but often terminating in a broad flat circular surface. You will also observe, as the creature struggles to escape from your grasp, and tries to get a hold on something with its claspers, that these limbs, if we may so call them, are retractile, and are sometimes completely drawn into the body. Finally, examine the broad end of a clasper with a magnifier, and you will see it surrounded by a circle of little hooks, turning in all directions. You will no longer wonder how it is that a caterpillar can hold so tenaciously to a piece of twig that it is often almost impossible to remove it without injury.

Now put your caterpillar down, so that you may observe its gait. If it happens to be one with the full complement of sixteen limbs, you see that at each stride it makes but little progress. The segments contract and relax alternately and in succession, thus sending a series of wave-like motions along the body, and urging onward the front segments while the claspers keep the hinder portion firmly fixed.

But if your caterpillar is one of the Geometers, with only two, or perhaps three, pairs of claspers, the mode of procedure is very different. The creature stretches its body out at full length, often raising its head high in the air, and swinging its long body right and left with a most furious motion, as if to hastily scan the neighbourhood. Then, having satisfied itself as to the *direction* of its proposed course (which, by the way, is often changed considerably at almost every stride), it holds on by the true legs and pulls its hinder quarters forward till the body forms almost a closed loop, with the fourth segment nearly touching the ninth. The claspers now become the holdfasts. The little hooks with which they are provided are firmly fixed to the surface on which it is walking; and the body being again straightened out to its utmost length, the same manœuvre is repeated. So, you see, the insect progresses by strides equal in length to about six segments of the body, and these the longest segments generally; and the rate at which the strides succeed each other, especially in some of the smaller species, is really astonishing.

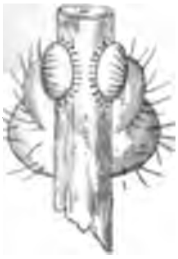

FIG. 26.—THE CLASPERS OF A CATERPILLAR.

We have seen the caterpillar in the act of taking its walk, and now we will give it a twig of its food plant so that we may see it feed. It walks up the twig without hesitation (for caterpillars (excepting those which feed on roots) always seem to move upward when in search of food) and soon finds itself on a leaf. Over this it walks till it reaches the edge; and, grasping the edge firmly between the claspers, so as to give perfectly free play to its legs and head, it stretches its body at full length, and takes a series of bites as it brings its head backward in a curve. When the head has thus been brought close to its fore legs, the body is again extended, and the same ground is gone over again.

If the caterpillar is a fairly large and hardy one, it will bite through the smaller veins, and perhaps even the larger ones; but the smaller species often change their position on reaching a moderately thick vein, and so devour little else than the soft cellular substance of the leaf. In any case, it is astonishing to see how rapidly the leaf disappears under the influence of the powerful jaws and marvellous digestive apparatus of the hungry grub.

Those who take a delight in watching the *movements* of caterpillars are sure to be interested in observing them when at rest; for at such times the various attitudes assumed are as pleasing and instructive as are their active moments. And these attitudes are all the more interesting on account of the mimicry by which the creatures often baffle their numerous enemies. We may profitably spend a little time in studying a few cases in point.

Many species, when at rest, fix themselves by means of their claspers to a small twig or leaf stalk, or on the midrib of the leaf itself. Here they remain perfectly still, with their bodies perfectly straight or with head slightly raised. I need hardly say that these generally fix themselves on the *under* side of the leaves and stalks, thus securing themselves against the attacks of the feathered foes above. But some birds are equal to the caterpillars in this matter; and it is really amusing to see them hopping about beneath the leaves in our gardens, every now and again slyly turning one eye upward, and smartly plucking an unwary grub from its resting place.

The precautions of the caterpillar, however, do not end merely with the selection of an under surface. You will find that the bright green species invariably settle on a leaf or a *green* stalk, while the darkly coloured insects often choose a twig covered with a brownish bark. Some even make for the *trunk* of the tree on which they feed, and here remain quite still in a vertical position, so that they look just like a ridge in the bark, the colour of which is faithfully imitated by their skin. Further, many of the caterpillars that resort to this stratagem have bodies that are notched or knotted and spotted in such a manner that the resemblance to their surroundings is so perfect as to defy any but the most experienced eye. And even this is not all, for a number of these mimics of the insect world never venture to feed by day, but take in their quantum of provisions during the dark hours, and practise their deceptions throughout the day.

Most of the Geometer caterpillars, of which we have already spoken, are well trained in the art of deception. You are out on a caterpillar hunt, and engaged in carefully turning over the twigs of the hazel or some other shrub, so that you may the more readily examine the under surfaces of the leaves. At last you lay hold of a small broken twig for this very purpose. To your astonishment it is very soft, and readily bends between your fingers. You look more closely at this peculiar piece of stick, and find, to your surprise, that you have grasped a looper caterpillar that was standing out at an angle just like a broken twig, supported by its two pairs of claspers, and coloured and knotted exactly like the little branch on which it rested.

At other times you meet with little green caterpillars of the same group, supporting themselves in exactly the same manner on a small twig, and looking just like a leaf stalk from which the blade had fallen or been devoured.

What a wonderful power is exhibited in the grasp of the claspers and the tension of the muscles, enabling the caterpillar to fix itself and retain its position for so long a time! Imagine an acrobat fixing himself by his hands on an upright pole, throwing out his body at an angle, and without any further support retaining his position motionless for several hours!

Other experiences of the larva hunter are equally interesting and, perhaps, even more tantalising. He is engaged in very cautiously turning over the leaves of a certain food plant from which he hopes to obtain the larva of a much-coveted species. Then, just as his eye catches a glimpse of the very object of his search, down falls the caterpillar, rolled up into a little ball, among the herbage below. This latter is diligently and patiently examined. But no, the anticipated prize is nowhere to be seen. It is probably a green one, and this adds to the difficulty of the patient entomologist. Then, as he carefully separates the low herbs, hoping to find the spot where the larva had fallen, the insect, rolled up into a compact little ball, only sinks deeper and deeper into the maze.

Many caterpillars avoid capture in this manner, while others seek to avoid detection by remaining perfectly motionless, even when roughly handled. They allow themselves to drop from their resting place on the slightest sign of danger, and, when the alarm is over and all is quiet again, they ascend the food plant and resume their position.

Some caterpillars not only rest, but even feed under cover, quite secure from most, if not all, of their enemies. Several of them feed on roots, and many a farmer can relate sad experiences of the havoc committed by these caterpillars on his turnips and other crops. Then there are those which feed on flowers and buds, completely burying themselves in the dense mass of food.

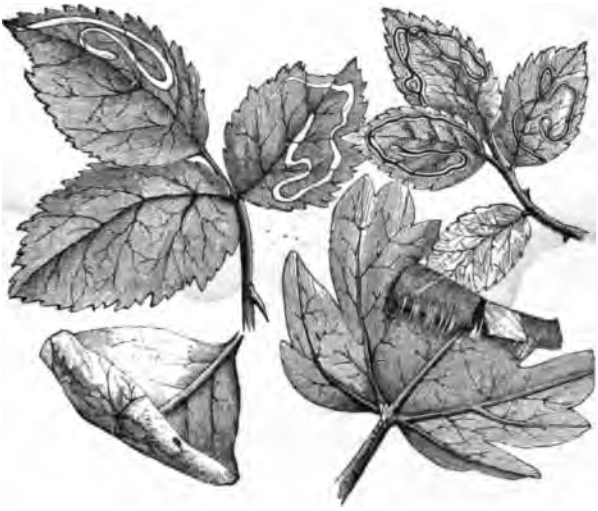

FIG. 27.– THE HOMES OF LEAF MINERS AND LEAF ROLLERS.

We must conclude this brief account of resting and hiding places and attitudes of caterpillars by a few observations on the leaf miners and leaf rollers.

The former are very small caterpillars—the larvæ of certain small moths—that eat burrows into leaves without doing any considerable injury to the outer *epidermis*, and thus prepare a safe resting place within the substance of their food.

The latter, also mostly of small size, make themselves secure by curling a leaf or a portion of a leaf into a cylinder, and holding it in position by means of a number of silken threads.

If you examine a leaf thus curled you will soon be convinced that a considerable number of the extremely delicate threads must be necessary to hold it in position; but, if you would like to know how a very small and feeble caterpillar can manage to roll up a comparatively large and rigid leaf, you must watch the little creature at its work.

You need have but little difficulty in finding a willing worker, for such caterpillars are extremely numerous. Take a few out of their self-made homes, place them on a sprig of the food plant, and you will soon have the pleasure of seeing one start its extraordinary work.

At first it spins a number of threads stretching from the edge of a leaf to about the middle of the surface. These threads are not tight by any means, and the leaf is, as yet, unchanged in position. But now the little mechanic exhibits a tact that almost seems to prove a knowledge of the principles of its art. Each thread in turn is pulled *at right angles* at its middle, and then fastened by means of the creature's spinneret. Each time this is done the edge of the leaf is bent round *a little*; and when at last the cylinder is completed, a number of other threads are stretched across from the scroll to the flat part of the leaf to secure it firmly in its place.

Many caterpillars are solitary in their habits: that is, they are always found singly, whether walking, resting, or feeding. But a large number of species are gregarious, living in dense clusters either throughout their larval state or, perhaps, only while young. In many such cases it is difficult or even impossible to find any reason for this gregarious tendency—to discover any advantage that the insects may derive from the habit. Many species, however, are true co-operators in the defence of their communities. The caterpillars of such live in clusters, sometimes several scores in each, and all help in the spinning of a complicated mass of silk fibres, which, with the leaves and twigs they join together, form a safe home in which they can rest, feed, or change to the chrysalis state. In early summer hundreds of such caterpillar 'nests' are to be seen in many of our hawthorn and other hedgerows.

Before closing our general account of the caterpillar we must have a word to say about the breathing apparatus, more especially as in our future descriptions we shall frequently have to mention the colours and markings which surround the openings in its body through which the air supply is admitted.

If you examine the sides of the segments of a caterpillar, using a lens if the insect is a small one, you will observe some little round holes, often inclosed in a ring or a patch of some prominent colour. These are the *spiracles* or openings of a series of air tubes called *tracheæ*. These latter divide and subdivide within the body of the caterpillar, the branches of one often uniting with those of another, thus forming a really complicated arrangement of air pipes by which the supply of oxygen is distributed.

A microscopic examination of a portion of one of the tracheæ will show that its walls are supported by an elastic spiral of a firm substance. This arrangement serves to keep the air passages open, and secures for the caterpillar a free supply of air at times when a contraction of the segments would otherwise cause the tubes to collapse.

There are nine spiracles on each side of the caterpillar's body, and never more than one in the side of the same segment. The head, which we have been regarding as the first segment, has no spiracles. The second segment has a pair—one on each side. There are none in the third and fourth; but all the segments, from the fifth to the twelfth inclusive, have each a pair; the last (thirteenth) segment has none.

We have already observed the general arrangement of the caterpillar's limbs; but perhaps it may be interesting and even convenient to the reader to give here a little table that will show at a glance the disposition of both limbs and spiracles.

First segment – head.	Two short antennæ, two jaws, and twelve eyes.
Second „	Legs and spiracles.
Third „	Legs only.
Fourth „	Legs only.
Fifth „	Spiracles only.
Sixth „	Spiracles only.
Seventh „	Spiracles, and sometimes claspers.
Eighth „	Spiracles, and sometimes claspers.
Ninth „	Spiracles, and sometimes claspers.
Tenth „	Spiracles, and generally claspers.
Eleventh „	Spiracles only.
Twelfth „	Spiracles only.
Thirteenth „	Claspers only, and these occasionally absent.

We must now watch the caterpillar through its later days, to see how it prepares for passing into the pupal stage, and to witness the various interesting changes that take place at this period.

When fully grown, it ceases to eat, and begins to wander about in search of a convenient spot for the coming event. Its colours fade, and the body becomes appreciably smaller, especially in length, as it ejects the whole contents of its digestive apparatus. According to some accounts, it even evacuates the lining of the intestines with their contents.

A great variety of situations are chosen by the different species at this time. Some will fix themselves on their own food plant, and there remain till they finally emerge in the perfect state, suspending themselves from a silken carpet, hiding themselves in a rolled leaf, or constructing a cocoon of some kind. A large number walk down the food plants, and undergo their changes in moss that happens to lie at the foot; or construct a cocoon on the surface of the ground, utilising for the purpose any decayed leaves, fragments of vegetable matter, or pieces of earth or small stones. Many seek a further protection than this, and burrow into the soil, where they either lie in a little oval cell that they prepare, or in a cocoon constructed by spinning together some particles of earth. Again, there are those caterpillars, chiefly of butterflies that frequent our gardens, which find their way to the nearest wall or fence, and there secure themselves in a sheltered nook. We will watch a few of these varied methods of procedure, taking as our first instance the caterpillar of the common Large White or Cabbage Butterfly.

When fully fed, this larva seeks out a sheltered spot, generally selecting the under surface of some object, or of the ledge of a wall or fence. Sometimes it will not even leave its food plant, though it generally walks some considerable distance before a suitable shelter is found. Having satisfied itself as to the site of the temporary abode, it sets to work at spinning a silken carpet. At first the threads spread over a rather wide area, and seem to be laid in a somewhat irregular and aimless manner; but after a little time its labours are concentrated on one small spot, where it spins several layers of silk fibres.

This done, it fixes the little hooks of the claspers firmly in its carpet bed, and then proceeds with a highly interesting movement. It is not satisfied with only the one mode of suspension. In fact, this alone would hardly be safe, for when it casts its skin, as it is shortly about to do, its claspers will all disappear; and although it afterwards secures itself by the 'tail,' it would be dangling in such a manner as to swing with every breeze—a very unsatisfactory state of affairs, especially with those that pupate late in the summer and remain in the pupal state throughout the winter storms.

Its next procedure, then, is to make a strong silk band round the middle of its body, so as to keep it close to the surface against which it rests. But how is this to be done? It bends its head round till the spinning organ can be applied to a point close beside the middle of its body. Here it fixes one end of a thread; and then, gradually twisting its body, brings its head round to the other side, still keeping it close to the same segment, and fastens the other end of the thread exactly opposite the point at which it started.

The head is now brought back to its former position, thus adding another thread to the band; and the process is repeated several times, till at last the caterpillar is satisfied with the thickness and strength of the cord formed.

Now it straightens out its body as if to rest from its labours; but the work is not yet complete. Soon it exhibits much restlessness. Its foremost segments are seen to shorten, and consequently become thicker. Then the skin splits, and the last moult of the caterpillar commences. The movements that follow are exactly similar to those we have already described in connection with one of the earlier moults: the alternate and successive contractions of all the segments gradually force back the old coat, and this is finally thrown entirely off by a somewhat vigorous wriggling of the 'tail.'

Then, for a moment, the creature is supported only by its silken cord. But this lasts *only* for a moment. For, as soon as it is quite free from the old garment, it applies its tail to the densest part of the carpet it had prepared at the start, and secures its hinder extremity by means of little hooks.

But what a change has now come over the creature! It is no longer a caterpillar. Its head is no longer distinct, although we can readily make out the positions of the eyes. Its mouth and jaws have quite disappeared, and the legs and claspers are apparently gone. The three segments that bore the legs are no longer distinctly separable, though in reality they still exist. The head and thorax are peculiarly shaped; and, instead of being cylindrical, are angled and ridged; but, beneath the soft greenish skin—the new garment—

we can discern the outline of a pair of small wings, and see a proboscis and a pair of long antennæ. Also the six long legs of the future butterfly can be traced with care.

The abdomen is conical in form, coming to a sharp point at the end, and its segments are quite distinct.

No stranger to the metamorphoses of insects would connect the present form with that of a caterpillar; they are so very unlike. And yet the time occupied in the whole change, from the spinning of the carpet, does not occupy more than about thirty or thirty-five hours.

The apparent suddenness of this change is really surprising, but in reality the transformation is not nearly so sudden as it appears. Dissection of a caterpillar a few days before the final moult is due will show that the changes are already going on. In fact, a simple removal of the skin will prove that the organs of the future butterfly are developing. Still, in proportion to the short time occupied, the change is extremely great; and it may reasonably be inquired, Why so great a change within so short a space of time?—why is not the change continued steadily and equally through the larval existence? The reason has already been hinted at. Caterpillars are living eating machines, whose office is to remove excess of vegetable matter. Consequently they must have their jaws and bulky digestive apparatus in full development to the end. If these organs were to *gradually* disappear as the caterpillar reaches its non-eating stages, it would simply be starved to death. So the change from the larval to the pupal state, which we may regard as the final moult of the caterpillar, is a far greater change than any of the preceding ones, and occupies a proportionately longer time, although it is principally confined to the last few days of the caterpillar life.

A number of caterpillars, and especially those of the butterflies, suspend themselves when about to change; and the peculiarities of the modes adopted must be left for our descriptions of species in a future chapter; but we will find room here for one more interesting example, taking this time the larva of one of the commonest of the Vanessas (page 166) the Small Tortoiseshell Butterfly.

The caterpillars of this insect are gregarious when young; and if ever you meet with one, you are almost sure to be able to obtain a hundred or so without much searching. But as they grow older they feed singly, yet generally without straying very far from their birthplace.

When full grown they sometimes stray to a neighbouring plant or fence to undergo the change to a chrysalis, but more commonly they are perfectly satisfied with the protection afforded by the leaves of their food plant. We will now watch one of these as we did the larva of the Large White Butterfly.

Of course the under side of the leaf is chosen. Here a silken carpet is spun as before described; but the caterpillar, instead of clinging with *all* its claspers, suspends itself in a vertical position by its hindermost pair only.

Here it hangs, head downwards, awaiting the coming events. The splitting and casting of the skin goes on just as in the case of the Large White, but there is this puzzle to be solved: how can the insect shuffle itself out of its old coat without falling to the ground, leaving the cast-off garments still hanging by the hooks of the claspers? This really seems a matter of impossibility, since the little hooks which alone suspend the insect are thrown off with the skin of the claspers.

The thing is managed in this way. As the skin slowly splits through the wrigglings of the apparently uncomfortable occupant, it is gradually pushed backward—that is, upward—till it is in a shrivelled condition, and the body of the insect is nearly free. But the chrysalis thus brought to light is provided with little hooks on the end of its 'tail' by which it can attach itself to the irregularities of the crumpled coat. Its conical abdomen is also very flexible, and it can, by bending this, seize hold of a ridge in the skin, holding it between the segments. Thus, although practically quite free from the old garb, it never falls to the ground.

There is now, however, another point to be attended to. The newly formed chrysalis desires to be entirely independent of its cast-off skin, and to suspend itself directly from the silky carpet it has prepared. To this end it works steadily for a time, alternately bending its supple abdomen from side to side, gripping the folds of the skin between the segments, pulling its body a little higher at each movement, and securing itself at each step by the little hooks at its extremity.

So it climbs, and at last it reaches the network of silk fibres, and thrusts the tip of its abdomen among them till some of the hooks have taken hold. Not satisfied with this, it turns its body round and round to get the little hooks so entangled between the silk fibres that a fall is impossible, and in so doing it frequently pushes the old skin out of its place so that it falls to the ground.

Although the caterpillars of this species do not show any great gregarious tendency when nearly full fed, yet it is not an uncommon thing to find several hanging from the under surface of one leaf, all being attached to the one common carpet at which all had worked. And when bred in confinement, a number will often spin in company in a corner of their cage. I have thus obtained a cluster of thirty-seven pupæ, all hanging by the 'tails' to the same mass of silk, which was so small that they formed quite a compact mass of beings with their tails close together.

We have seen that the Large White Butterfly makes itself secure by a silk band round its middle, while the 'Tortoiseshell' is fixed only by its tail. But the extra provision for the safety of the former is not so necessary in the case of the latter, as it never spends more than two or three weeks in the pupal state. Here it is the perfect insect that braves the winter, and not the chrysalis.

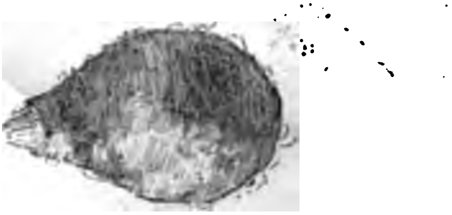

FIG. 28.—THE COCOON OF THE EMPEROR MOTH.

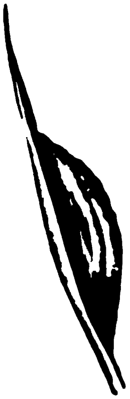

FIG. 29.—THE COCOON OF THE SIX-SPOTTED BURNET (*Filipendulæ*).

There is a great variety in the means taken by the caterpillars of moths to protect themselves during their metamorphoses, but we shall have space for only a few illustrations.

A clever cocoon is spun by the larva of the Emperor Moth (*Pavonia*). It is pear-shaped, and composed of a brownish silk; and is so constructed that the newly emerged moth can easily walk out of the small end without breaking a fibre, while the entry of an insect enemy from without is impossible.

This is managed as follows. A number of rather stiff threads are made to project from the small end of the cocoon, and these converge as they pass outward so that the ends are all near together. The other portions of the cocoon are of compact silk, and any insect intruder that ventures to enter by what we may almost term the *open* end is met by a number of spikes, as it were, that play on it at every attempt. Many of these wonderful cocoons may be found during the winter months attached to the food plants of this insect.

Of the silken cocoons spun by various caterpillars some are so thin and light that the chrysalis can easily be seen through them, and others are so densely woven as to be quite opaque. A great difference is also to be observed in the adhesive power of the silk fibres. In some cases little threads of silk can be pulled off the cocoon; but some of them, that of the Oak Eggar (page 229) for example, look as if they had been constructed of paper rather than of silk, because, at the time of spinning, the moist silk fibres stuck so closely together.

An extreme case of this character is to be met with in the cocoon of the Puss Moth (page 285); for here the fluid from the spinneret of the caterpillar does not harden at once on exposure to air, and so the threads become thoroughly united together, thus forming a solid gluey cocoon.

When the Puss caterpillar is about to change, it descends the tree (poplar, willow, or sallow) till it is within a few feet of the ground. Then it commences gnawing away at the bark, at the same time cementing all the pieces together with the gluey substance from its spinning glands. In this way it surrounds itself with a very hard cocoon, which so closely resembles the surrounding bark in colour that detection is difficult indeed.

But how will the caterpillar proceed if it is removed from its native tree and has no bark to gnaw? That you can easily answer for yourself, or rather Puss will answer it for you. Go and search among the poplars, willows and sallows in the month of July. You may possibly come across a caterpillar that is just in the act of creeping down the bark in search of a resting place; but if not you may be successful in obtaining a few either by examining the twigs, or you may start them from their hiding places by smartly tapping the smaller branches with a strong stick.

Having secured one or more larvæ, take them home, and they will give some rather novel performances. If they are not fully grown, you must supply them with fresh leaves every day till they refuse to eat; and then is the time for your experiments. Shut one in a little wooden box, and you will have the pleasure of watching it construct a cocoon of chips of wood that it has bitten out with its powerful jaws, all joined together into a hard shell by means of transparent glue. Shut another Puss in a glass vessel—a tumbler, for instance—either by placing it under the inverted vessel, or by covering over the top. Perhaps it will not be superfluous to mention that, should you place it under an inverted vessel, this vessel should not stand on a polished table, for, whatever be the material, unless *extremely* hard, it is sure to be utilised in the manufacture of the cocoon.

Let us suppose, then, that the caterpillar is under an inverted tumbler that stands on a plate or saucer. Now it is for *you* to decide what material shall be used in the construction of the new home. Give Puss some fine strips of brightly coloured ribbon, and it will construct a very gaudy house by gluing them together. Or, provide it with sawdust, pieces of rag, glass beads, sand, paper, anything in fact; and the material will be 'made up' into a cocoon more or less ornamental according to the nature of the supply.

But what if you give it *nothing* with which to work, and so inclose it that nothing its jaws can pierce is within its reach? For instance, shut it in with tumbler and saucer as before, inverting the former on the latter, and give it no material whatever. What will it do now? We will watch and see.

At first it is very restless, and walks round and round the edge of the tumbler, evidently a little dissatisfied with the prospects. Then, after a little while, the events of nature transpiring in their fixed order regardless of trivial mishaps, the glutinous fluid begins to flow from the creature's spinning glands, and it moves about in a somewhat aimless fashion, applying the transparent adhesive matter both to tumbler and saucer.

It seems now to become a little more reconciled to its unnatural surroundings; and, making the best of bad matters, keeps its body in one place, and starts the construction of a ridge or barrier all round itself. By the continued application of the creature's spinneret this barrier is made gradually thicker and higher, till at last the overhanging sides meet and the caterpillar is inclosed in its self-constructed prison. But the walls of this prison are so transparent that every movement can be watched, and, after the insect has spent a few days in completing the cocoon, we can see it cast off its old skin, and appear in the new garb of a fine greenish chrysalis.

Its soft green skin soon hardens and turns to a rich dark brown colour, and it settles down for a long rest lasting till the following May or June.

When the whole operation of building is completed, lift up the tumbler, and up will come the saucer too. The two are firmly glued together by the substance secreted; and the power of this as a cementing material will be well illustrated if you endeavour by mere pulling force to separate the two articles.

The Puss is not the only caterpillar that works up a foreign material with the contents of the spinning organs. There are several others, in fact, that use for this purpose fragments of wood or other parts of the food plants; and a still larger number bind together leaves, fresh or dead, or particles of earth or other matter. Several such cocoons will be described in our accounts of individual species in another chapter. We shall now devote a little space to a few general remarks on the chrysalides and the final metamorphosis of butterflies and moths.

CHAPTER IV

THE PUPA OR CHRYSALIS

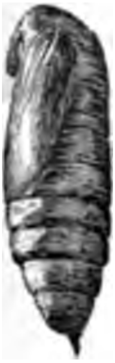

FIG. 30. — THE PUPA OF THE PRIVET HAWK (*Ligustri*).

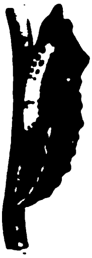

FIG. 31. THE CHRYSALIS OF THE LARGE WHITE BUTTERFLY (*Brassicæ*).

As soon as the last moult of the caterpillar is over, the chrysalis that had already been developing under the cover of the old skin is exposed to full view; and although the perfect insect is not to be liberated for some time to come, yet some of its parts are apparently fully formed.

The newly exposed skin of the chrysalis is very soft and moist, but as it hardens it forms a membranous or horny covering that protects and holds firmly in place the trunk and the various limbs and appendages that are distinctly to be traced on the under surface.

If, however, you examine a chrysalis directly after the moult is over, you will often find that the wings, antennæ, proboscis, and legs of the future butterfly can be easily separated from the trunk of the body on which they lie by means of a blunt needle, and can be spread out so as to be quite free from that surface.

In form the chrysalides of butterflies and moths are as variable as the caterpillars. Many of the former are sharply angular like that of the 'Small Tortoiseshell' already mentioned; but some of the butterflies (the Skippers, page 197) have smooth and tapering chrysalides, and so have most of the moths.

In colour they are equally variable. Some are beautifully tinted with delicate shades of green, some spotted on a light ground, some striped with bands more or less gaudy and distinct, but the prevailing tint, especially among the moths, is a reddish brown, often so deep that it is almost a black.

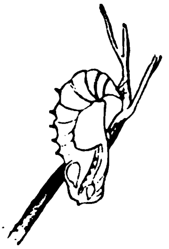

FIG. 32. — THE PUPA OF THE DARK GREEN FRITILLARY (*Aglaia*).

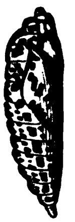

FIG. 33. — THE PUPA OF THE BLACK-VEINED WHITE BUTTERFLY (*Cratægi*).

As a rule there is no marked resemblance between the different stages of the same insect. Thus, a brilliantly coloured caterpillar may change to a dull and unattractive chrysalis, from which may emerge a butterfly or moth that partakes of the colours of neither. But in a few cases there *are* colours or other features that remain persistent throughout the three stages, or show themselves prominently in two.

An interesting example in point is that of the Magpie or Currant Moth (page 279). The caterpillar of this moth is cream-coloured, with orange stripes along the sides, and very bold black markings down the back. The chrysalis, which is at first entirely yellow, afterwards turns black with the exception of some yellow transverse bands. Then, the moth exhibits the same colours as these two earlier stages, with the same degree of boldness; for its pale cream-coloured wings, tinted with patches of yellow, are marked with numerous deep black spots. Thus, in this case, we find the same general character of the colouring throughout the insect's existence.

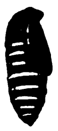

FIG. 34. — THE PUPA OF THE CURRANT MOTH.

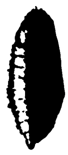

FIG. 35. PUPA OF THE PALE TUSSOCK MOTH (*Pudibunda*).

Another interesting example, though not so striking as the last, is to be found in the case of a group of moths known as the *Liparidæ*. The caterpillars of these are remarkable for their very hairy bodies, often ornamented by several bold brush-like tufts. The chrysalides are also hairy; and several of the moths themselves are not only thickly clad with shaggy hair, but a bold tuft often tips the abdomen.

We must not leave these few remarks on the characters of chrysalides without a mention of the brilliant spots of burnished gold that decorate the pupæ of certain butterflies. This is the feature that led to the invention of the term *chrysalis*, which is derived from the Greek word *chrysos*, meaning *gold*. For the same reason the term *aurelia* has been applied to the pupæ of *Lepidoptera*, this being derived from *aurum* the Latin name for gold.

Strictly, then, these two terms apply only to the pupæ of a certain number of the butterflies; but the former is now generally used to designate the pupæ of all the *Lepidoptera*, and is even extended to the corresponding stages of insects of other orders.

If you examine one of these gold-speckled chrysalides, the brilliant metallic lustre seems to belong to the outer surface, just as if certain spots had been tipped with real gold; but after the butterfly has quitted its case the beautiful golden spots are gone. This proves that the metallic appearance is not due to reflection from the outer surface of the chrysalis, but to a reflection from some structure beneath it. This latter is a very thin membrane which lies just under the outer transparent covering of the chrysalis.

The period during which the *Lepidoptera* remain in the chrysalis state varies very considerably in different species, and also depends more or less on the temperature. As a rule, when a caterpillar pupates before the end of the summer, it remains dormant in the pupal condition for only a few weeks; but, if late in the summer or in the autumn, it remains in this condition throughout the winter, and emerges in the following spring or early summer.

Both these conditions are illustrated in the life history of the Large White or Cabbage Butterfly—an insect with which we have already become acquainted. We get two distinct broods of this butterfly every year, the first appearing in May and the second in August. The eggs of the first brood hatch in about a fortnight, and the larvæ are full grown about four weeks later. These then change to chrysalides from which the perfect insects (the second brood) emerge in a few weeks, the period varying slightly with the temperature of the season. From the eggs of this second brood we get another and larger army of cabbage eaters that change to pupæ late in the summer. These remain dormant till the following

April, and may be found in numbers throughout the winter, attached to the walls and fences of kitchen and market gardens.

If, then, the pupæ of the same species are so influenced by the temperatures of the seasons, can we limit or prolong the period of quiescence by subjecting them to high or low temperatures artificially produced? Most certainly we can; and every practical entomologist knows how to obtain the perfect butterflies and moths of certain species long before their appointed times, or, if he desires it, to compel them to remain in their dormant stage long after the natural period has terminated.

Sometimes an enthusiastic insect hunter obtains a large number of what we may term 'winter pupæ,' by collecting and breeding various species. He also anticipates a number of successful captures of perfect insects during the following summer. Thus, from two distinct sources, he obtains a goodly assortment of butterflies and moths, the setting, preserving, and arranging of which entails an immense amount of home work.

Under such circumstances he will sometimes endeavour to cause some of his pupæ to emerge before their accustomed time, so that he may get some of his insects 'on the boards' before his field work is in full swing, and so avoid a rush, or prevent the loss of insects that will be spoiled before he has time to take them in hand.

This process of hurrying up his pupæ he calls 'forcing,' and simply consists in keeping them for a time in a warm room or hothouse where the high temperature is pretty constant.

On the other hand, the entomologist may desire to try the effect of a continued *low* temperature on his pupæ. This he can do by placing his pupæ in an ice house. Such experiments have often been performed, and the results are very interesting. In some cases the emergence of the perfect insect has been delayed for many months, and even years; and then, after an exposure to a normal temperature lasting only a week or two, the winged insect has made its appearance just as if nothing unusual had happened.

Such are the effects of *extreme* temperatures on the duration of the chrysalis state; and we naturally infer, from such results, that the pupa under natural conditions is influenced, though in a lesser degree, by the variations experienced with the seasons, especially in such a fickle climate as our own.

The insect hunter has always to bear this in mind, and particularly so when he sets out on a search for certain desired species. Suppose, for example, he has set his mind on the capture of a certain butterfly that *usually* appears in the *first* week in May. Before finally naming the day, he has to consider what the weather has been during the last few weeks, and if he finds that this has been much warmer than the average for the corresponding periods in the past, he selects a day in *April*, earlier or later according to the difference between the present season and the average.

If he does not pay due attention to such considerations, he will sometimes find that all the insects netted are shabby and much worn, even though, under average conditions, he would be catching newly emerged and brilliant specimens. This, then, will explain how it is that we so often see in entomologists' periodicals startling accounts of 'early captures,' and of the appearance of certain insects late in the season that *ought* not to have emerged till the following summer.

I will give just one illustration of these variations. The beautiful Orange Tip Butterfly (Plate I. fig. 7) generally appears about the middle of May in the southern counties. Farther north it is of course a little later. In the north of England it has been taken in June; and in Scotland as late as July. On the other hand, I have taken it in Gloucestershire as early as March, on a rather bleak day with a cold east wind; and, withal, in a field on the slope of the Cotswolds fully exposed to the unfavourable breeze; but it was evident that, in this case, the butterfly had been enticed from its winter quarters by the milder weather of the few previous weeks.

It may be as well, in passing, to observe that it is not only the pupa that is influenced by temperature. The hatching of eggs may be forced by high temperatures, or be retarded by exposure to cold; and in nature the period of incubation varies with the seasons. The larvæ, too, grow faster or more slowly, or pupate earlier or later from similar causes. And so no very definite date or period can be assigned to any one stage of any insect.

Now let us return to one of the chrysalides that we have already watched through the earlier stages of its existence, and follow it in its future development.

It is now, as we say, in its quiescent or dormant condition, but we must not suppose that it is always in a profound sleep, nor can we say that it is insensible to its surroundings. Touch it gently or surprise it with a puff of air from your mouth, and it will begin to wag its pointed tail, sometimes with such vigour as to send the body rolling round and round in its box. Lay it on a bed of cocoa nut fibre or finely sifted soil and let it remain *quite undisturbed* for a few hours or days, and you will probably find that, by occasional movements of its body, it has made a slight depression in its bed, and lies partly submerged. I have known some chrysalides to completely bury themselves in this way during the course of a day or two, and others to partly expose themselves after having been lightly covered. Others again, I have observed, will move smartly if a strong light is suddenly turned on them. Many, too, certainly appear to have a strong objection to exposure to the direct rays of a hot sun; for, when thus exposed, they will struggle persistently, as if to work their bodies into some shady corner. I would not advise a young entomologist to try this experiment, however, if he values the pupæ he possesses, for direct sunlight is undoubtedly very harmful to many species, and perhaps it is to all.

Some chrysalides are not nearly so active as has just been represented; in fact, there are many which seem to show no signs of life during the greater part of the time spent in that state. But in all, whether apparently active or not, certain important internal changes are at work. We have already noticed that, even in the last days of the *larval* existence, some of the organs of the future imago are to be traced. But these are as yet imperfectly developed. We have also observed that a continuation of these changes, gradually carried on, would be impossible in a voracious feeder; so the insect, now fully grown, and no longer requiring a supply of food, settles down in perfect quiet, submitting itself quite passively to any further changes that nature may demand.

It has already suffered the loss of its claspers. Its wonderful jaws that did so much damage (for good or evil as the case may be) to the vegetable world are now gone, and the bulky digestive apparatus has rapidly dwindled to useless dimensions. These and other changes, already in progress, have to be perfected while the creature is in a restful and helpless condition, though they may often be retarded or even suspended during cold weather when progress would certainly bring it to an untimely end.

But now the grandest of all these transformation scenes is nigh at hand. The protective skin is already loosening from the almost perfect imago, and consequently feels softer and far more yielding than it did when in close contact with the body: the swaddled butterfly or moth (for such the pupa is) is slowly preparing to throw off its imprisoning garb. The wings and large compound eyes are assuming their final colours, which now begin to show themselves through the more or less transparent skin, and the long legs, the perfectly formed antennæ, and the slender proboscis, all of which are folded closely under the creature's thorax, now begin to move within their loosened sheaths.

Now let us watch it closely, for one of the most wonderful sights ever witnessed by a naturalist is about to be presented to our view. We think we can observe slight movements; and, it may be, we can actually see the struggling insect endeavouring to set itself free. The legs and proboscis are moving within the loosened skin; and lo! as we watch these motions, the prison wall bursts with a slight snapping noise (at least, such is the case with some of the larger species), and in a moment out pop a few long legs which immediately struggle for a foothold. The proboscis also appears, alternately lengthening itself out and coiling into a spiral, as if impatient to reach the sweet nectar from the bottom of some fragrant flower cup.

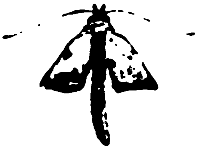

FIG. 36. A BUTTERFLY, JUST AFTER EMERGING.

All this takes place in less time than one requires to describe it; and, before many seconds have passed, the struggling insect has quite completed its last moult, and is bidding good-bye to the rent garment that has done it good service for so long a time.

But how dreadfully disappointing! Did we not say only a few minutes since, that a beautiful butterfly or moth was about to emerge? How, then, is this? Here is an odd-looking creature, such as we have never seen before! True, it has the right kind of body, though even that is so soft and heavy that it is fairly dragged along as the insect walks. Its antennæ, too, seem to be just the right thing—that is, just what we were expecting to see. But oh! the wings! Are we looking at a deformity? a failure on the part of Nature to produce what she ought?

We will not judge hastily, but continue to watch it a little longer. It seems very restless at first, and, with the fluttering apologies for wings, drags its heavy body along till it reaches some surface up which it can climb. If nothing of the kind is close at hand you may place a *rough* upright stick in its path, and it will immediately begin to ascend. Its motto is now 'Excelsior!' and its ambition to rise may be so great that, on reaching the very top of the stick provided for it, it struggles for a still higher position in life till, failing to get a foothold in the air itself, it falls to the ground and has to retrace its steps.

I once thought I would like to test the perseverance of a large moth in performing its first upward journey; and as it was one from a chrysalis to be found in nature at the foot of a tree that attains some considerable height, I was, of course, prepared to exercise a little patience myself.

As soon as the moth had emerged, I placed it at the bottom of a window curtain that hung from about eight feet high to the floor. In less than half a minute it had reached the top, and was struggling hard to get still higher. I took it down, and again placed it at the bottom. Up it went as fast as before; and this was repeated nine times with exactly the same result. For the tenth time I placed the persevering creature at the bottom of the curtain; and, after it had walked about halfway up, it *suddenly* stopped, apparently quite satisfied with having travelled a distance of over seventy feet in an upward direction. Its six legs were immediately arranged symmetrically in a business-like manner, and there it settled quite still, as if it had some definite object in stopping just exactly in that spot.

But we must now return to our own insect, which has by this time settled itself in a similar manner on the stick we provided for it. The peculiar organs which represent the wings, though so very small, show distinctly, in miniature, the colour and pattern of the fully developed wings of the species. An interesting change is just now commencing. These wings are apparently growing larger, but the development is very unequal, so that they become curled and crumpled till they are even more unsightly than before. All seems to be going amiss. But this lasts only for a short time. The fluid from the body steadily rushes into the *nervures*, causing the wings to expand, and in a few minutes the beautiful pinions are stretched to the full extent, assume their normal shape, and expose the full glory of their brilliant colours.

It may be interesting if I give an example showing the exact time taken for the full development of the wings of a certain insect. So I will here quote an entry from my note book; and, by the way, let me strongly advise all my young readers who follow up this subject to habitually enter in a book kept specially for the purpose all facts which strike them as they pursue their study of nature. The note to which I refer runs as follows:

'Early on the evening of the 22nd [April] I selected a few chrysalides of Populi [the Poplar Hawk Moth, page 209] which, from the looseness of their cases, were thought to be just on the point of emerging. At 8.46 one of them showed signs of restlessness; and, after a few vigorous movements, during which it rolled itself over on the glass [I had placed the pupæ on a piece of plate glass so that slight movements might be more easily detected], the front of its case was suddenly thrust off with considerable force; and in *less than four seconds* the imago was quite free and crawling on the table. After trying hard to reach a higher point than was provided for about four minutes, it rested to expand its wings now about seven-sixteenths of an inch long, or one-third the total length of the body. At 9 o'clock the wings reached half the length of the body, and were much curled. At 9.12 they were fully expanded and straightened out.'

From this extract we see that the whole period from the bursting of the case to the full expansion of the wings was only twenty-six minutes; and it will be well to remind the reader that the process occupies even a much shorter time than this with many species, both of butterflies and moths. It will be observed, also, that the *evening* was chosen as the time for the observation. There was a reason for this. The Poplar Hawk Moth, as is the case with many others, almost invariably emerges from the chrysalis in the evening—usually after dark. But it may be mentioned in passing that a far larger number of the *Lepidoptera* as invariably emerge in the morning.

Again we will return to our newly emerged insect, for there are still one or two interesting points to observe. The wings have fully expanded, it is true, but how very limp they are! Take the creature on the tip of your finger and hold it so that its body is in a horizontal position. Immediately the wings bend downward with their own weight, so soft and flexible are they. The body, too, is still very soft, and apparently much too heavy for flight. Then, if you place it on a flat surface, it will immediately try to find some perpendicular or overhanging surface from which it can suspend itself by means of its legs, so that the pendant and straightened wings are in the best possible position for drying. As the insect walks away in search of such a resting place, the body still drags as it did before, and the wings bend over, either both on one side or one on each side of the body.

It is some time before the wings are sufficiently dry and rigid for flight, but the period varies greatly with different species.

Some of the small butterflies and moths take to flight long before an hour has passed, but in many cases several hours elapse before the creature starts from its first resting place. Butterflies that emerge in the morning spend their first day actively on the wing; but the nocturnal moths that emerge early in the day do not fly till evening twilight. When, however, the time arrives, the insect flutters its wings as if to test their power before committing itself to the air; and frequently, after only a few seconds spent in this preparatory exercise, off it darts with astonishing rapidity. But others seem far more cautious. They vibrate their wings, sometimes with such rapidity that they are lost in a kind of mist, and with such power that their bodies would be carried suddenly into the air were they not firmly anchored by three pairs of hooked claws. Then, continuing the rapid vibration, they move slowly along, always holding on firmly by one or more legs, as if to still further satisfy themselves concerning the efficiency of their wings. Then they venture on a few short trial trips from one neighbouring object to another, and at last gain sufficient confidence for a long voyage.

How strange must be the feelings of a winged insect during its first flight! After a long period during which it was a helpless, crawling grub, and this followed by a term of imprisonment during which it was almost or quite shut off from the world, it now suddenly acquires such great powers of locomotion that it is often a match for ourselves.

But, alas! this life is short. A few days spent in sporting with those it meets and in sucking the sweet juices of many flowers; then a day or two during which the female deposits its eggs; again a few days employed in pleasures that become less and less attractive, till, at last, the creature becomes weary of life and settles down to die.

We have now traced the complete life history of the *Lepidoptera* from the egg to the perfect insect, avoiding descriptions that apply only to certain species as far as possible, excepting where such are useful as illustrations.

Only one thing more remains to be done before we start in real earnest with our practical work. We shall shortly be giving hints on the modes of capture, the 'setting' and the preservation of butterflies and moths. And in so doing we shall often have to observe important points in which our dealings with these two great divisions of the order will differ very materially. Hence we must not consider ourselves ready to proceed with the practical portion of the entomologist's labours till we are perfectly satisfied that we know the main features that enable us to distinguish between the butterflies and the moths, and also know just a little concerning the subdivisions on each side.

This, then, shall form the subject of the next short chapter.

CHAPTER V

CLASSIFICATION OF THE LEPIDOPTERA

THE *Lepidoptera* are divided into two very unequal groups, to which we have so frequently alluded as 'Butterflies' and 'Moths.' And, although these two terms are popularly applied in a fairly accurate manner, yet, strange to say, very few persons indeed have any definite knowledge of the differences that entomologists recognise between the two groups.

Every entomologist has his circle of sympathetic and, perhaps, even admiring friends. Consequently, many a little package is sent round to his abode 'with great care,' accompanied by a note or a message concerning the fine 'butterfly I have just caught, and thought you would like to add to your collection.'

The 'butterflies' that so frequently reach us through these channels nearly always turn out to be *brightly coloured* moths, and this naturally gives one the idea that the popular notion as to the classification of the *Lepidoptera* is based on colour or brilliancy of design, the term 'butterfly' being applied to the gayer species, and 'moth' to the more dingy members of the race.

There is really some shadow of a reason in this method of nomenclature, for butterflies *are usually* more brightly clad than moths; but the scientific classification, at least as far as the main divisions and subdivisions are concerned, has nothing whatever to do with colour or design; and we must at once acquaint ourselves with the fact that there *are* very dingy butterflies, and most beautiful and highly coloured moths.

How shall we account for the fact that the specimens so kindly sent us by our friends are generally moths? Is it because moths are more numerous and more frequently seen? They are certainly more numerous; for, while our butterflies do not number seventy species, the other division contains about two thousand. Yet, in spite of this fact, moths are not generally observed as much as butterflies, for the former are nearly all night-fliers, and the latter *always* fly by day and rest by night.

Still our question remains unanswered. The reason is this. The captives sent us are seldom caught on the wing. Most of our grown-up friends, even though they admire our own pluck and general carelessness concerning the remarks of the spectators of our entomological antics, would not themselves like to be seen, hat in hand, chasing a butterfly; and the night-flying moths are, of course, less frequently observed. But they often, in the course of their daily employments, meet with a large moth fast asleep in some corner of a dwelling house, workshop, or outhouse. Such moths are easily caught while in the midst of their slumbers, and, as they often make no attempt to fly by day, are as easily transferred to a box suitable for transmission by messenger or by post.

In the above few remarks we have alluded to some features by which the two great groups of the *Lepidoptera* may be distinguished; but we have already referred (page 5) to a far more important one in our description of the various forms of antennæ. All butterflies—at least all *British* butterflies—have knobbed or clubbed antennæ, while the corresponding organs of all our moths terminate in a sharp point.

This distinction obtains in all British *Lepidoptera*, and is so far regarded as the most important basis of classification that naturalists have derived from it the two Greek terms that are synonymous with our two popular names—butterflies and moths. The scientific name for the former group is *Rhopalocera*, a term derived from two Greek words, one signifying a horn, and the other a club, and thus meaning 'club-horned.' The corresponding name for moths is *Heterocera*, derived from the same source, and meaning 'variously horned.'

But, although we find embodied in these two long and formidable names an unerring mark of distinction between British butterflies and moths, we must not neglect other less important facts which, though less distinctive, are not without interest.

Observe a butterfly at rest. Its wings are turned vertically over the back, and brought so closely together that they often touch. In this position the 'upper' surfaces of the 'upper' wings are completely hidden from view, and the 'under' surfaces are exposed on the two sides, except that those of the 'upper' pair are partly hidden by the other pair.

Now look at a moth under the same circumstances, and you will generally find the wings lying over its body, which is almost or completely hidden beneath them. As a rule the upper pair together form a triangular figure, and entirely cover the second pair; but in some cases a portion of each of the under wings extends beyond the margin of those above them, and in others the upper pair extend so far forward that nearly the whole of the under wings is exposed behind them.

Again, the wings of butterflies are so rigid that they can never be folded; but you will observe that the under wings of moths are generally very thin, soft, and pliant, and are neatly pleated lengthwise when not in use.

Another feature deserving notice is a slight difference to be often observed in the form of the body. The butterfly, which generally has a slender body, has a distinct constriction or waist between the thorax and abdomen. This is not so apparent with moths, and especially with the thick-bodied species.

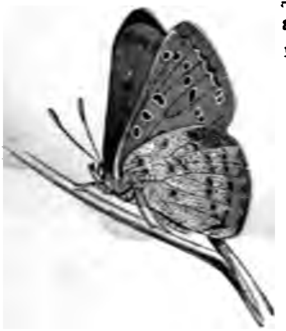

Fig. 37. A Butterfly at Rest (Large Copper).

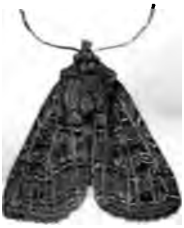

Fig. 38. A Moth at Rest (Gothic).

The ***Rhopalocera*** or Butterflies are divided into *Families*, each of which contains insects that possess certain features in common by which they may all be distinguished from the members of any other family.

The British species represent eight families. They are as follows:

1. *Papilionidæ.*—Containing only one British species—the beautiful Swallow-tail (Plate I, fig. 1).

2. *Pieridæ.*—Containing ten species. These are often known collectively as the 'Whites,' but include four butterflies that are distinguished by beautiful shades of yellow and orange.

3. *Nymphalidæ.*—This family contains seventeen insects, among them being several splendid species. It includes the Fritillaries and Vanessas.

4. *Apaturidæ.*—Of this we have only one representative the Purple Emperor (Plate V, fig. 1).

5. *Satyridæ.*—Including the 'Browns' and 'Heaths,' and numbering eleven species.

6. *Lycænidæ.*—Including the Hairstreaks, 'Coppers,' and 'Blues,' in all seventeen species.

7. *Erycinidæ.*—Containing only the 'Duke of Burgundy.'

8. *Hesperiidæ.* This family contains seven British butterflies commonly known as the 'Skippers.'

Although all the members of the same family resemble each other in certain points of structure, or in their habits, yet we can often find among them a smaller group differing from all the others in one or two minor particulars. Such smaller groups are called *Genera.*

To make this all quite clear we will take an example.

The Brimstone Butterfly (Plate II, fig. 4) belongs to the second family *Pieridæ, all* the members of which are distinguished from those of the other families by the characteristics mentioned on page 141.

But our Brimstone Butterfly possesses another very prominent feature in which it differs from all the other British *Pieridæ,* and that is the conspicuous projecting angles of both fore and hind wings. Among the foreign species of the family we are considering there are several that possess these angles; but as there are no others among our own members, the 'Brimstone' is placed by itself in the list of British *Lepidoptera* as the only member of the genus *Gonopteryx* or 'angle-winged' butterflies.

Thus the full relationship of this butterfly to other insects may be shown in the following manner:

The Brimstone Butterfly.

ORDER.	*Lepidoptera*
Section.	*Rhopalocera*
FAMILY.	*Pieridæ*
GENUS.	*Gonopteryx*
Species	*Rhamni*

Now, every butterfly has a Latin or Greek name in addition to that by which it is popularly known. I should have said *two* Latin or Greek names. The first of these is always the *generic* name, and the second is the one by which we denote the particular member or *species* of that genus. Thus, the scientific name of the Brimstone Butterfly is *Gonopteryx Rhamni.*

'But,' the reader may be inclined to ask, 'why should we not be satisfied with the one popular name only?' And, 'If we *must* have a separate scientific name, could we not find suitable terms among our English words to build up such a name—one that might express the principal characteristics of the insect, and also serve all the purposes of classification?'

Such questions sound very reasonable, and so they are. But the entomologist's answer is this. We ourselves may get on well without the help of the dead languages, but we have brother naturalists all over the world, speaking a great variety of different languages. We endeavour to help one another—to exchange notes and generally to assist one another in our labours; and this can be greatly facilitated if we all adopt the same system of nomenclature. The educated of most of the great nations generally know something of Latin and Greek, and consequently the adoption of these languages is generally acceptable to all.

This sounds well, but for my own part I believe that if we are to make any branch of natural history a popular study, especially with the young, we must to a certain extent avoid anything that may prove distasteful. There is no doubt whatever that many a youngster has been turned away from the pursuit of the study of nature by the formidable array of almost unpronounceable names that stretch nearly halfway across a page; and those who desire to make such a study pleasant to beginners should be very cautious with the use of these necessary evils. One would think, on glancing over some of the scientific manuals that are written 'especially for the young,' that the authors considered our own too mean a language for so exalted a purpose, for in such works we find all or nearly all the popular names by which the schoolboy knows certain creatures he has seen entirely omitted, and the description of a species appended to a long Latin term that conveys no idea whatever to the reader, who is studying the description of a well-known animal or plant and doesn't know it.

Our plan will be to give the popular names throughout, except in the case of those few species that are not so well known as to

PART II

WORK AT HOME AND IN THE FIELD

CHAPTER VI

CATCHING BUTTERFLIES AND MOTHS

It is not at all surprising that entomology should prove such a fascinating study to the young, and more especially that portion which deals with the department we are now considering. Butterflies and moths are among the most beautiful and most interesting of living creatures. The study of their life history is enchanting, and the creatures themselves are of such a size as to be conveniently handled and preserved, and withal occupy so little space that anyone with only moderate accommodation may possess a fairly typical collection.

Compare the work of the entomologist with that of one whose hobby is the study of mammals. The latter has to deal with large and cumbersome objects, a collection of which requires an enormous amount of space; and, unless he has the time and means to travel in foreign countries, he cannot get together a good typical collection of specimens representing his particular branch, for the few British mammals contain no representatives of several of the orders into which the class is divided.

Entomology is undoubtedly, *par excellence*, *the* study for youngsters. It is equally suited to the studious and to those of an adventurous turn of mind. It leads its follower into the bright sunshine and the flowery meadows; and with body and mind pleasantly occupied, the joy of living is deeply felt. The necessary apparatus can be made by anyone. No dangerous gun is required, and there are no precipitous rocks to scale. When the autumn flowers fade the year's work of the entomologist is not done, for the arranging of his cabinet and the demands of his living specimens keep him more or less actively engaged until the flowers of the following spring call both him and the insects he loves once more into the field. And so, season after season, and year after year, he finds himself engrossed in labours so fascinating that idleness the curse of so many of our youths is with him an impossibility.

I assume that the readers of this book have a desire to take up the study of one branch of entomology--that of butterflies and moths--in real earnest; that they intend not only to *read* about these interesting insects, but to *know* them. And there is only one way in which one may really get to know living creatures; that is by searching them out in their haunts, observing their growth and habits, and by an occasional close examination in order to become acquainted with their structure.

Hence I shall in this, the practical portion of the work, give such information as will assist the beginner in catching, preserving, rearing, breeding, and arranging the specimens that are to form his collection.

Catching Butterflies

There was a time when we would try to capture a butterfly at rest on a flower by a quick sweep of the hand, or, more commonly, by a sharp downward stroke of the cap. We were led to this action by a mere childish love of sport, or by a desire to possess an insect simply because it was pretty. When we succeeded in securing our prize, we handled it somewhat carelessly, often passing it from one hand to the other, or boxing it in our closed and perspiring fist till our fingers were dusted with the pretty microscopic scales of the creature's wings, and the wings themselves, stripped of all their beautiful clothing, were merely transparent and veined membranes. Having thus carelessly but unintentionally deprived the creature of its greatest beauty, we set it free, often in such a damaged or exhausted condition that the poor thing could scarcely fly.

But our childish ideas and inclinations have vanished. Now we would rather watch the insect than catch it, for we find much pleasure and interest in its varied movements. And if for purposes of study we occasionally require to make one captive, we proceed in such a manner as to preserve its beauty unimpaired. The cap now gives place to a well-made and suitable net; and we are careful to provide ourselves with sufficient and proper accommodation for our captives.

It is probable that many of my readers are as yet unacquainted with the nature of an entomologist's requirements for field work, so we shall describe them, confining ourselves at first to those that are required for a butterfly hunt.

First and foremost comes the net. This essential portion of your equipment may be either purchased or constructed by yourself. Very little skill is required to enable you to do the former. Provided your pocket is well charged, you may start off at once to the dealer in naturalists' appliances, and treat yourself to a complete outfit. But even in this case a little advice may not be out of place. See that what you purchase is very *strongly* made. You can get nicely finished nets constructed on the most convenient principles, made to fold and go in an ordinary coat pocket, but with *weak joints*. See that you have the most convenient form of net by all means, but do not go in for convenience and appearance at the expense of strength and durability. Nothing is more annoying than to find your net give way just when you are in the midst of a good day's sport.

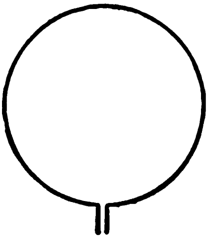

Fig. 39.—A Wire Frame for a Butterfly Net.

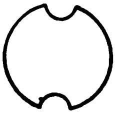

Fig. 40.

The folding net is certainly very convenient, for you can conceal it in your pocket while you are walking through town or travelling in a railway carriage, and thus avoid that contemptuous gaze which certain of the public are prone to cast on a poor 'bug hunter.' And although such nets are generally purchased, yet they *may* be constructed by anyone who has had experience in the working of metals. But other forms of nets, equally useful and even stronger, can be made by anybody; and I will give a few hints on two or three different ways of putting them together.

A very simple and strong frame for a net may be made as follows: Get a piece of stout iron or brass wire about forty inches in length, and bend it into a circle with the two ends, turned out about two inches each, at right angles to the circumference as shown in the accompanying sketch.

Now take a good tough stick, the length of an ordinary walking stick, and cut out two grooves opposite each other at the end, just large enough to take the straight ends of the wire. The end of the stick will now resemble fig. 40 in shape. Place the ends in their grooves, and bind them tightly to the stick by a good many turns of rather fine wire.

A frame well made after this fashion is as strong as anything you could desire, but it has the disadvantage of being always fixed to the handle, thus preventing the use of the latter as a walking stick when you are not directly engaged in your entomological work.

A much more convenient frame may be made by thrusting the ends of a piece of cane into the two narrow arms of a metal Y. You may purchase the Y at any of the naturalists' stores, or you can make one yourself if you know how to perform the operation of soldering. I have always made mine with odds and ends of brass tubing such as old gas pipes. One piece must be just the size to fix on the stick; and the other two must fit the cane tightly. The three pieces must be filed off at the proper angles, and the doubly bevelled end of the wider tube must then be flattened down to the width of the smaller ones before soldering. If you decide to buy one, give the preference to strong brass rather than the cheaper and more fragile ones made of tinned iron.

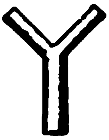

Fig. 41.
The Metal Y.

The advantage of such an arrangement over the last frame is evident at once. The cane, with net attached, can be pulled out of the Y when not in use, and bent small enough to go in the pocket or a satchel; and the Y can also be separated from the stick, thus allowing the latter to be used as a walking stick.

Some entomologists speak very favourably of what is known as the 'umbrella net'—a large and light net that will shut up like an umbrella, and may even be made to look very much like this useful protector, but the possession of such an imitation is somewhat tantalising in a pelting shower. The ring of this net consists of two steel springs attached to a couple of brass hinges, one of which is fixed near one end of the handle, while the other slides up and down in the gamp fashion.

One other form of net—'the clap net'—although still occasionally seen, has had its best days. Two sticks are provided to this one, so that the two sides of the net may be brought together on the insect; but as both hands are required to manage it, it is almost surprising that it ever had any advocates at all.

When your frame is completed, sew round it a strip of strong calico, to which the net itself may be afterwards sewn, for the lighter material of the net is too delicate to stand the constant friction against the metal or cane frame.

The material usually employed in making the 'bag' is called leno. It can be purchased at most of the drapers' shops, and three colours white, yellow and green—are usually kept in stock Measure the circumference of your net frame, and see that you get sufficient leno to make a good full net. Suppose, for instance, that the circle of your frame measures thirty-six inches round, then your leno should be at least forty inches in length. Fold this double, and then cut out two pieces of the shape shown in fig. 42, letting the depth of the net be nearly or quite equal to the width of the material. There is nothing to be done now but to stitch the bag together and sew it to the calico on the ring.

At first you will find the leno rather stiff and harsh, but a damping and good rubbing between the hands will soften it down; or, if you prefer it, you may soften the material by a slight washing before cutting out the net. The latter is perhaps the better plan, for the washing will remove the objectionable 'dressing' that renders the material rather hard and stiff.

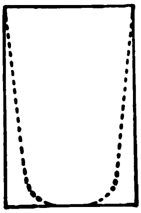

Fig. 42.

Of the three colours mentioned above, green is the one most generally chosen, because it is more in harmony with the surroundings of a butterfly catcher; but many prefer the white leno to the green, as the insects are more easily seen in a net of this colour. Yellow is certainly not a desirable tint.

As a rule it will be necessary to kill an insect as soon as it is captured. This is always the case with butterflies unless you require to keep them alive either to watch their movements or to obtain eggs. For this purpose you will require a killing bottle or box containing some volatile substance.

The selection of this necessary piece of apparatus is a point deserving of much consideration, for so many different forms are in use by different entomologists, and so many advocates each declare that his own plan is far superior to that of any of the others, that the final decision is not to be worked out in a moment. The best thing for a beginner is to try as many as he can, and then, after some considerable experience of his own, he will be able to decide which apparatus suits himself best.

I recommend this because it is impossible to say of any one plan that it is the best, for that which gives perfect satisfaction to one individual will often fail to give anything but annoyance in the hands of another.

To enable my young readers to follow the advice I have just given, I will describe some of the commonly used killing arrangements and show how they should be used.

I will take first the 'cyanide bottle.' This is a wide-mouthed bottle, containing a very poisonous substance called *cyanide of potassium*. It is fitted with a good sound cork. The 'cyanide' is a solid substance, and must be fixed in some way or other at the bottom of the bottle so that it cannot shake about and damage the butterflies.

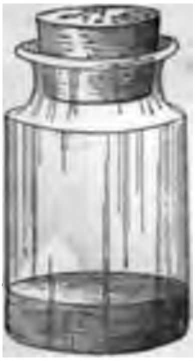

FIG. 43. THE CYANIDE BOTTLE.

A cyanide bottle can be purchased ready for use at the cost of a shilling or thereabouts; but if you are old enough to be trusted with deadly poisons, you may buy the 'cyanide' of a chemist who knows you well and is satisfied as to your intentions, and then prepare your own. Every entomologist should know how to do this, for the poison loses its power after some time, and it is not always convenient to leave your bottle in the hands of a chemist or a 'naturalist' to have it recharged. This will cost you more than it would to do it yourself, but that is nothing compared with the annoyance that may result when, the night before an anticipated butterfly hunt, you are calmly told that 'your bottle will be ready in a few days.' You can charge it yourself in a few minutes if you can manage to keep a small supply of 'cyanide' in stock, and it is ready for use very shortly after.

Here is the *modus operandi*. Purchase an ounce or two of the cyanide of potassium, and immediately put it into a stoppered or well corked bottle. Label it at once, not only with the name, but also with the word POISON in very large and conspicuous letters. This dangerous chemical is often sold in sticks that look much like certain 'sugar sticks' I was acquainted with in my younger days; but whether this is or is not the case with your cyanide, see that the bottle is kept quite out of the reach of the inquisitive and sugar-loving juveniles of the house.

The quantity above mentioned is more than you will require for the first 'charge,' but you will soon experience the convenience of having a supply always at hand for recharging when your cyanide bottle fails to do its work expeditiously, or when an accident calls for the somewhat sudden appearance of a new one.

Now procure a bottle for your work. Its mouth must be wide enough to take the largest insect you hope to catch, and the widest part of the bottle need not be much larger. Get a perfectly sound cork to fit it tightly; and, to insure the more perfect exclusion of air, paint over the top of the cork with melted paraffin wax.

Dissolve a few drams of the cyanide in a little water, using a glass rod to stir up the mixture till the solid has all disappeared; and be careful that neither the solid nor the solution touches the skin if it should be in the slightest degree scratched or broken. Now sprinkle plaster of Paris into the solution, a little at a time, and stir all the while. As soon as the mixture begins to set, pour it into your bottle as cleanly as you can—that is, without touching the sides—and press it down with the flat end of a stick if it is not level. Now cork it, and put the bottle away in a cool place till required for use.

This is, I think, the best way of charging the bottle; but there are two other common methods that may, perhaps, be regarded as a little more simple. One is this: put a few small lumps of the 'cyanide' into your bottle, and then cover them with a stiff mixture of plaster of Paris and water, and press down as before. The other plan is to cover the 'cyanide' with a few thicknesses of blotting paper, cut just a little larger than the inside of the bottle. The first of these two methods is fairly satisfactory, but I have always found that the charge, when made in this way, has a tendency to become wet and pasty, in which condition it will spoil the wings of the insects. The other is very objectionable, especially for field work, for the blotting paper fails to keep its place while you are on the chase. If the plaster is used, the mixing must be done quickly and without hesitation, or the mixture will become solid before you can press it into your bottle.

We will not enter now into the *pros* and *cons* of the cyanide bottle, but will consider the advantages and disadvantages of the various methods of killing the insects after we have noticed a few more.

The 'laurel box' has had many devoted advocates, although it does not seem to be much in use now. It is a very good arrangement, however, but is a little more troublesome than the cyanide bottle, as it requires frequent replenishing.

A very good laurel box may be prepared as follows. Get a small tin box of cylindrical form, measuring about five inches by two, and cut a circle of perforated zinc or wood just the size to fit it snugly as a false bottom without any danger of falling out of its place. Now gather some of the young leaves of the green laurel bush, and beat them almost to a pulp with a mallet or hammer. Place this in your tin box, and press down the perforated false bottom on it. The bruised laurel leaves give off a very powerful odour, which stupefies butterflies immediately.

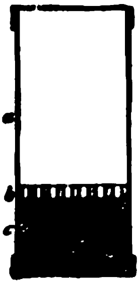

Fig. 44. —Section of the Laurel Box.

a, space for insects; b, perforated partition; c, bruised laurel leaves.

Of course the reader may be able to think of various other ways in which the laurel box may be made. Any arrangement will do providing the vapour can come to the insects without allowing the leaves to touch their wings; and any ingenious youth could manufacture a more satisfactory article than the one I have mentioned. My desire is, as far as possible, to give instructions that may easily be carried out by anyone, even if he has not the slightest mechanical skill, leaving the clever youth, sometimes, the opportunity of displaying his own inventive power. But in this case I will give a few suggestions concerning other ways in which a laurel killer may be constructed. A firm and *fixed* false bottom is a decided advantage. This is easily managed by fixing a circular piece of perforated zinc or 'tin' by means of a little solder; or even a wood partition may be used, fixed with a few brads, driven into it from the outside. With the fixed partition, however, you must have a lid at each end of the box. This is easily managed if you get two tins of the same size, knock out the bottom of one, and fit the lid of the other in its place.

I have heard of laurel boxes without any partition save a piece of rag in which the bruised leaves are wrapped. The whole is *pressed* down so firmly that it is not likely to be displaced while you are on the chase. I do not recommend this, for in addition to the chance of its slipping there is a danger of the sap of the leaves exuding through the rag and spoiling the insects' wings. But if the reader should prefer to try this on account of its simplicity, it will probably occur to him that a bottle may be used instead of a tin box.

A well-made laurel box, with a fixed metal partition, is a piece of apparatus strongly to be recommended to all young entomologists who desire to test the relative value of the various poisons that are used by the different experts; for with it any one of these substances can be used. In the poison compartment you can place pieces of 'cyanide' wrapped in blotting paper, or any kind of porous substance moistened with liquid ammonia, chloroform, benzole, or any other volatile liquid insecticide. All the above-named substances are declared to be 'the best,' so they must all be worth the trial.

'Cyanide' is valued on account of its lasting powers. A cyanide bottle well charged will retain its efficiency throughout a whole season. I always recharge two in the spring, one for active service in the field and the other as a reserve force; and these kept in a cool place do good execution throughout the year. If they should exhibit a slight failing, a few minutes' warming before a fire will improve them; but for field work it is better to recharge. At the same time see that the corks are in good condition.

Next to the 'cyanide,' the bruised laurel takes the first rank for permanency; but you must not expect this to last many days. For a few days' continuous work one charge will suffice, but if the laurel box has not been in use for some time you must have a fresh supply.

The liquid poisons, such as ammonia, chloroform, and benzole, are so volatile that they are very powerful for a short time, but so much vapour is lost each time the box is opened that it is absolutely necessary to carry a bottle of the one you use into the field with you. Also see that you have sufficient of the blotting paper or other absorbent to prevent the liquid from leaking through the perforations of the partition.

If you choose ammonia—a substance that is not regarded as a poison, and is therefore easily obtained from any chemist—always get the strongest, and see that it is labelled 'Liq. Ammonia, S.G. ·880' as a guarantee. A small bottle such as you can conveniently carry in the waistcoat pocket will contain sufficient for a day's work. Use only a few drops at a time, but renew frequently. Although the ammonia corrodes cork yet a good cork is far preferable for the pocket to a glass stopper, for its elasticity prevents it from losing its hold, and the liquid from saturating your pocket and its surroundings; but a glass stopper is certainly better for the stock solution kept at home.

Most of the above remarks apply equally well to benzole and to chloroform, but the latter is so powerful a poison that a very little is required for a day's work, and consequently a very small bottle is more convenient. The dealers in naturalist's appliances supply metal 'chloroform bottles' with screw stoppers and a small nozzle that will allow the liquid to run out only in drops. This is a very good arrangement, since it enables you to avoid the 'drop too much' which is not only unnecessary and therefore wasteful, but saves you from experiencing the disappointment of an empty bottle before your work is half done.

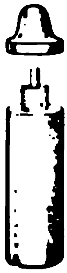

Fig. 45.—The Chloroform Bottle.

Some entomologists recommend the solid carbonate of ammonium instead of liquid ammonia, but this is not so powerful. It must be remembered that we have the butterflies to consider, as well as our own convenience, in the selection of the poisons we use. It is the opinion of many well-known entomologists that 'insects cannot feel pain,' and that we are therefore at liberty to deal with them in any way we please. Still it is as well to save all possible suffering, and be satisfied with no killing box that is not practically instantaneous in its effects.

Among other poisons used by entomologists I may mention sulphur fumes and tobacco smoke. The former may be obtained by burning a little sulphur or a sulphured lucifer match under the perforations of a killing box of the pattern described, and the latter—well, every smoker knows that. I should at once condemn the former method, at least for field work, as troublesome and inconvenient; and as to the other, I have tried the effect of a puff (and many puffs) of tobacco smoke on an imprisoned insect, but was so dissatisfied with the result that I am not likely to do so again.

We have now considered a good many insecticides more or less suitable to our purpose, but there still remains the unsolved problem as to which is the best. Each one has its advantages. For convenience nothing beats the cyanide bottle. It is very speedy in its action, and the use of a bottle is a little preferable to a metal box, for you can always satisfy yourself as to its efficiency without opening it. Cyanide, chloroform, benzole, and some others render the insects more or less brittle and stiff, so that it is not so easy to 'set' them for the cabinet. Perhaps, if you happen to have a supply of growing laurel close at hand, you cannot do better than stick to the laurel box. The time taken in bruising up a few leaves is inconsiderable, and the moisture given off from them will keep your insects moist and supple, or will even 'relax' them if they have become rigid. But try various plans for yourself, and you will be able to settle a question which all the entomologists in the world cannot answer for you—which method answers best in *your* hands.

The next item for our consideration is the 'collecting box.' This is merely a box in which the butterflies are pinned as soon as they are dead. Here, again, we shall note a few variations from which a selection can be made according to the means or the ingenuity of the reader. For a couple of shillings you can obtain a good zinc collecting box, lined with cork, of oval form (a most convenient shape for the pocket), and quite large enough for one day's captures; and half that modest sum will purchase a wooden box, also lined with cork, adapted to the same purpose.

As with many other things, so with collecting boxes, the cheapest is often the dearest in the end. You may feel inclined to save a shilling by buying a wooden box, but you are sure to discard it after a little practical experience for a metal one. We shall speak a little later on concerning the advisability of 'setting' the butterflies as soon as possible after capture; but this is not always practicable, especially after a good day's catch. Now, if the insects are pinned in a wooden box, they soon become dry and rigid, and consequently cannot be 'set' till they have been put through the more or less tedious process of 'relaxing.' If you use a wooden collecting box you will often find, on a hot and dry day, that all or nearly all your butterflies are rigid before you arrive home; but a metal box will keep them moist and supple, so that you can even put off the setting till the following day if you are unable to do it immediately after your return.

Another point worth considering is the best economy of space. If your collecting box is only about one inch deep inside, you have room for only one layer of pinned insects; but a box only a little deeper may be lined with cork both at top and bottom, and thus be made to accommodate double the number. The zinc boxes sold by the dealers are generally lined with cork in this manner, and are, of course, deep enough for the double layer of specimens; but the wooden boxes are sometimes lined on the bottom only. After these few remarks you will at once see the economy of expending the extra shilling on the former.

Although the prices of collecting boxes are low, yet there are many who would prefer making their own, and there is much to be said in favour of this. A great deal of pleasure is to be derived from the construction of your own apparatus, especially when that apparatus is afterwards to be used in the pursuit of a delightful hobby. During the whole of the time thus engaged, you are looking forward with the most pleasurable feelings to the glorious treat before you, and every joint you make seems to bring you nearer to the realisation of your joys. During the bleak winter months there is no better employment for an entomologist who has a little spare time than the preparation for the next outing. It is just one of those artful schemes by which he seeks to get as much pleasure out of life as it is capable of affording. How many there are who, for the lack of a pleasant and instructive hobby, find their leisure hours the most dismal of all, and who complain of the toil and wearisomeness of their lot! The mournful thought with them is, 'Is life worth living?' but who ever heard such an expression from the lips of an active entomologist?

But I must have done with moralising and proceed to business. The question is How shall we set to work about the construction of a collecting box? If it is to be a wooden one, select or make a box of such a size as to suit your pocket or satchel, and cover the bottom, and lid too if the depth allows of it, with sheet cork or slices of good wine corks, about one-eighth of an inch thick, fixed on with glue.

The metal box is not quite so easy, but even here you may save yourself much work by keeping your eyes open. Very neat little collecting boxes can be made out of the flat metal boxes in which are sold certain favourite brands of tobacco. Some of these are just the right depth, and also of a very convenient size for the coat pocket. Beg one of these boxes from a smoking friend, and if the lid is not held by a hinge (a great advantage, by the way), you can easily solder on a brass one.

All that remains now is the fixing of the cork. Buy a sheet of cork at a naturalist's shop, this being a commodity always in stock, and cut out two pieces just the size to cover the bottom and the lid.

Gum and glue are not very satisfactory as fixing agents, for, as you will presently learn, there are times when it will be necessary to keep the box moist, and moisture softens both these substances. The cork must be fixed by means of little strips of metal. Here are two ways of doing this:

First.—Cut a few little strips of sheet tin, each about two inches long and one-eighth wide. Double and bend them as shown in fig. 46, and solder them to the surfaces which the cork is to cover (fig. 47). As the cork is pushed in its place, these little slips are allowed to force themselves through slits in it made by means of a penknife, and then the ends are bent over as shown in fig. 48. Two or three such fasteners will be quite sufficient to hold down each sheet of cork.

Second. Put the sheets of cork in their places *first*, then make a few little slits through both metal and cork with the point of a penknife, and then bind the two together with a few ordinary paper fasteners. This arrangement is shown in section in fig. 49.

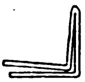

FIG. 46.

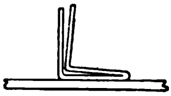

FIG. 47.

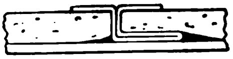

FIG. 48.

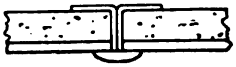

FIG. 49.

Just one point more concerning the metal collecting box. You will often call moisture to your aid in keeping the butterflies flexible and soft. This will have but little action on zinc, but will sooner or later cause the 'tin' (really tinned iron) box to rust. Here, then, is a point in favour of zinc, but still a home-made 'tin' collector will last a long time if kept dry when not in use.

As already hinted, there are times when it is desirable to take home certain butterflies alive, either for a study of their movements or for the purpose of securing eggs for breeding. To this end you must provide yourself either with a number of 'chip boxes' with a few small holes pricked in the cover, or with some metal boxes with perforations for the admission of air. If the latter, you will have no difficulty in securing a few 'tin' boxes of suitable size, but, as the surface of the metal is very smooth, you should always introduce a few leaves or something else that will provide a foothold for the inmates.

The last item of the outfit is the pins. Ordinary draper's pins are quite out of the question. They are far too thick and clumsy for the collector's work. If you are not already acquainted with the 'entomological pins,' you had better ask a dealer to give you a sample card. This will be very useful for reference until you become well acquainted with the various lengths, thicknesses, numbers and prices. The card will contain one of each kind, with price and number attached.

If you fix a butterfly with the ordinary pin, you may find the latter partly covered over with verdigris after a time. This bright green substance is formed by the action of decomposing animal matter on the copper of the pin, and gives a very unsightly appearance to the specimen. To avoid this the entomological pins are either silvered, blackened or gilded. The silvered pins tarnish after a time, but the two other kinds keep their colour well, and are therefore better. The gilded ones are rather expensive and unnecessary, and perhaps the black ones are to be preferred to the silvered, although they are rather more costly.

Most dealers will supply you with a box of mixed pins, each box containing about six different sizes. This is very convenient for those who work in a rather small way; but if you intend to make entomology a prolonged study you had better get an ounce or so of each of the more useful sizes.

Butterflies vary much in size, and Nos. 3 to 8 are the most useful sizes of pins to fix them; No. 3 being for the largest, and 8 for the smallest.

Supposing all the foregoing requisites to be quite ready, still you are really by no means prepared for all your work. The butterflies captured should be set as soon as possible after your return, and everything required for *this* part of the work must be in perfect trim. Yet I think it will be more convenient just now to confine our attention to the subject of 'Catching Butterflies,' leaving all the indoor work to form the substance of another chapter. Our next point, then, shall be the consideration of seasons, times, and localities.

The earliest of the butterflies make their appearance on the wing in April, or, if the weather is mild, towards the end of March;

and from this time you can find employment up to the end of September or the beginning of October—a period of about seven months. But it must not be supposed that all parts of this long season are equally prolific, and will yield equally valuable catches. Remember the short term of a butterfly's life, and bear in mind that each one has its own regular season in which to spend the winged state; you will then see that anyone who wishes to 'work' as many species as possible must arrange his outings in accordance with the insects' own times.

Some butterflies are double-brooded, and the two broods may not come forth at certain fixed times. Hence they seem to be on the wing almost without cessation for several months together, and therefore need not have a special day set apart for them. But others are more uniform in their date of appearance, and die off at about the same time. To catch such as these you must be careful to watch the weather, make allowance for any severities that may tend to cause a delay, or an unusually high temperature that may hasten their emergence, and then select a day in which you may expect to find them fresh and unworn. A week too early, and none are to be seen; a week too late, and nearly all you catch are worn and worthless.

A glance at our Calendar (Appendix II) will give you a few illustrations in point. Thus you will observe that May is a month for the 'Whites,' early 'Blues' and certain of the Fritillaries; July for most of the Hairstreaks and Browns, and so on. Before you have been long collecting you will have captured the very common species, and then you will find that your butterfly hunts are very unproductive unless you make it a point to try for certain species at the proper times.

Time, however, is not the only thing to take into account when preparing for a day with the butterflies. It is equally important that we should carefully select our locality in accordance with the known haunts of the various species. As long as you are simply working up the common kinds, you may wander almost at random in waste places, flowery meadows, corn fields, railway banks, &c.; but when you have secured a few specimens of each of these, you must search out the favoured resorts of the more local and the rarer species. For instance, wooded spots must be visited if you are to take certain of the Fritillaries, oak woods for the Purple Emperor and the Purple Hairstreak, fenny districts for the beautiful Swallow-tail, and so forth. In some cases the butterflies are closely restricted to certain isolated localities, to which you must travel if determined to obtain them.

There yet remains another important matter to consider, and that is the kind of day you shall select for your outing. Butterflies are not only strictly day-fliers, but most of them venture out only on bright days. Always choose as hot a day as possible, with a very bright sun. If you are to be out for a full day's collecting, manage to be on the hunting ground at about ten o'clock in the morning. As a rule there are not many out before this time, and some do not appear to stir till an hour later: still there are a few 'early birds' among them, one of which the Wall Butterfly I have seen on the wing before eight.

If your season, your day, and your locality are all well chosen, you may reckon on a good six hours' work. At about four the butterflies begin to lag, and then drop into their hiding places, one by one, till only a few of the late stragglers remain on the wing.

So far I have furnished some general instructions that may be regarded as preparatory to the start; but I will now give a few hints as to the mode of procedure when the day for field work has come.

First, see that you have secured *all* your apparatus, and that it is in perfect condition. What is more annoying than to find, after you have travelled some miles to get to your hunting ground, that you have left your screw ferrule at home, or that the soldering of your metal Y is just giving way? If you are troubled with a short memory, it will be advisable to make out a list of every requisite for your field work, and keep this for reference on all field days.

Here is a list of your equipment for a day with the butterflies. Net, ferrule or Y, stick, collecting box (the cork of which should be damped if the box is a metal one), a few 'chip boxes' for live insects, killing apparatus, a good supply of pins of several sizes, a piece of string, needle and cotton, and your penknife.

You observe in this list one or two items not previously mentioned, since they hardly come under the category of apparatus, but a moment's thought will convince you of their usefulness, especially in the case of a breakdown. If your net catches in a thorn—a very common occurrence—and a big rent is made, the needle and cotton will save you a deal of agony, and perhaps loss of temper. If your stick breaks under your exertions, the knife or the string may prove a most valuable companion. Your pins may be stuck in the cork of your collecting box, certainly the most convenient spot for immediate use ; but you may also have a reserve store in a small pocket cushion, or arranged neatly on a strip of flannel which can be rolled up in the waistcoat pocket.

At last you are on the hunting ground, fully equipped but inexperienced, and at first find yourself just a little awkward in the use of your new gear. Your experience with the cap has been a very wide one, and you are possibly an expert at knocking down 'Whites' in the streets and in your neighbour's kitchen gardens. Now you have to wield the net, and coax your captives into your killing bottle ; hence a slight feeling of incompetence at first.

You soon get over this, however, and within five minutes you may be seen furiously slashing away at all the poor butterflies that come within range, common 'Whites' and dingy 'Browns' receiving as much attention at your hands as any rare gem that may happen to cross your path.

How different are the movements of an experienced collector ! He walks stealthily along the route he has chosen, apparently taking but little notice of the majority of butterflies that approach and pass him. He has already secured his 'series' of nearly all the species, and is carefully on the watch for the gems that are required to complete his cabinet. His actions are slow and deliberate rather than rash ; and he trusts more to his eyes than his legs.

The beginner may take to his field work quite to his own satisfaction, and may travel homeward with a feeling of great pride over his first day's catch ; but yet there are a few points in which a little advice may not be quite out of place, particularly so with regard to the management of the net, and the killing and pinning of the insects.

Most of the butterflies may be caught on the wing, and it is far better to net them in the air than to sweep them off the herbage and flowers. If these are rather low, you should strike the net smartly *upwards* from below them, but of course this movement is impossible with insects that happen to be almost above your reach. If a butterfly is busily engaged in searching out its sweet food, flying from flower to flower, don't think of giving chase, but follow it up stealthily, and you will sooner or later get an opportunity of striking at it while in the air. Sometimes, however, you will see a powerful flier making a straight dash across your field, taking no notice whatever of the fragrant blossoms, but evidently engaged on some important errand. If such happens to be a species you require, then you must run for it, but you will probably be satisfied with only a few chases of this kind, particularly if the sun is very hot, and the ground diversified with clumps of furze, heather, 'molehills,' and ditches.

There are times when your only plan of netting a butterfly is to sweep it from a flower or leaf on which it has settled. If the vegetation is very low, you have simply to bring the net down upon it, and then, holding up the apex of the net with the other hand so as to give it room to fly, you can inclose it by grasping the lower part of the net as soon as the butterfly has fluttered upward. If the herbage is tall it is advisable to strike either upward or sideways at the insect, starting it from the leaf or flower on which it rests; for if you bring *down* the net you will have to inclose the whole or part of the plant on which the butterfly has settled—a procedure that often ends in a torn net, or in the insect becoming damaged through being rubbed against the plant.

Whenever you capture a butterfly by a sweep of the net through the air, you immediately turn the ring into a horizontal position, so that the bag of the net closes itself as it falls over the edge. This gives you an opportunity of examining the insect before you introduce your killing bottle. This is a very necessary precaution, for you are generally unable to judge of the condition of a butterfly while on the wing, and in some cases you cannot even be certain of the species. If, then, you were to call the killing bottle into requisition for every capture you make, you would certainly find yourself taking the life of many an insect that is of no use whatever to you. Always examine your specimens at the moment they have been secured, at least as far as it is possible to do so, by looking through the gauze; and let your examination be as brief as possible, or some of the butterflies that were at first in splendid condition will render themselves useless to you during their struggles to get away.

When satisfied that an insect is likely to be of value to you, keep it in the apex of the net by grasping the bag beneath it with the left hand, and then introduce the opened killing bottle with the other hand. As a rule you will experience not the slightest difficulty in [illegible] trap, and then you quickly cover the mouth of the [illegible] with the gauze. Then apply your left hand, using [illegible] temporary stopper for a few seconds, and now, the insect having been [illegible], replace the cork.

A good killing bottle is almost instantaneous in its action, not only stupefying, but immediately killing the insects; and as sóon as you are sure that each specimen is quite dead, you may pin it in your collecting box.

You must be cautious, however, on the one hand, that you do not take it out too soon. If you do you may find that it recovers from the mere stupefying effect of the poison, even after it has been pinned, and when you open your collecting box for the next butterfly, you are horrified at the sight of the poor victim struggling to free itself.

On the other hand, don't keep the insects in the killing bottle too long. If you do you will soon have a number, one lying on another, and all tumbled about together while you are on the chase. Of course, under such circumstances you are sure to damage them more or less.

Many collectors, although they may always use a killing bottle for moths, never employ one for butterflies, but kill them by pinching the thorax. It is well to know how to do this, for it sometimes turns out to be a really quicker process than that we have just been considering; and, more than this, you can resort to it should you break or lose your bottle while in the field. It is done in this manner: Bring the two opposite sides of the net together, closing them on the insect so that it cannot flutter. If now the wings are brought together over the back, all is right, but if not, give it just a little room to flutter till you have the opportunity of closing the gauze upon it with the wings in the desired position. Now pinch the thorax smartly between the finger and the thumb, applying the pressure outside the net, but be careful not to squeeze the abdomen. In a moment you will find the insect quite dead, and not in the least damaged unless you performed the operation clumsily.

Now as to pinning. Hold the dead butterfly between the finger and thumb of the left hand, and pass a pin of convenient size through the centre of the thorax above, and push it through so that the point appears centrally on the under surface. It is now ready for your collecting box.

So you work on till the sun begins to get low, and the butterflies become fewer and fewer, till only a few stragglers of common species are to be seen. Still there are a few hours of daylight and perhaps even of bright sunshine before you, and if you are not weary with the work done, you may very profitably spend these hours in the collection and study of the habits of moths.

Catching Moths by Day

The reason for choosing the sunny hours for butterfly collecting is obvious, all these lovers of brightness being then actively on the wing; and although many may be driven out of their hiding places by beating the herbage with the handle of your net, or even be searched out as they rest on stalks and leaves during dull days or at morning and evening twilight, yet such methods are comparatively tedious and unproductive.

Some moths also are lovers of sunshine, and while engaged in butterfly hunting you will often meet with a moth flying briskly from flower to flower and taking its fill of both sweetness and brightness. Again, as you wade among flowery herbs in quest of butterflies you will certainly disturb a number of moths, causing them to take a short flight in search of a safer spot. Thus you will almost invariably find a few moths among the contents of your collecting box even though you made no special effort to seek them out. But we shall now see how we may set to work to obtain a successful catch of moths at times when butterflies are not so much in demand, or during the less brilliant hours of the day, when butterflies are at rest.

The apparatus required for this work need not differ in any important respect from that recommended for butterflies. The same net is used, any reliable killing bottle will do, and the pins and collecting box used for butterflies are equally serviceable. But your mode of procedure is very different.

As you walk towards your proposed hunting ground you will do well to examine the trunks of trees, old walls, and wooden fences. In this way you will meet with moths fast asleep, which are consequently easily taken. All you have to do is to hold the open killing bottle obliquely just below the insect, and then push it gently downward with a small twig or stalk. As a rule the moth will drop direct into the bottle and make no attempt to fly away; but some are very light sleepers, ready to take flight at the slightest disturbance; and when dealing with these you must be careful to bring the mouth of the killing bottle so closely round them that there is no room for flight except into the bottle itself. It is well, however, not to [illegible] at this kind of searching, but to reserve as much as possible of your time for what you consider to be a very favourable [illegible].

Speaking generally, a good locality for butterflies is a favourable one also for moths, and you will do well to give special attention to well-grown hedges, especially those that surround clover fields; also overgrown banks, the borders of woods, open spaces in woods, the trunks of isolated trees, gravel pits, and old chalk quarries.

Walk beside or among the undergrowth of woods, or among the tall herbage of waste places, tapping the branches and twigs with the handle of your net as you go. Then, if your locality is well selected, you will rouse moths to flight at almost every stroke. Some of these will shoot upward among the lofty branches and disappear quite beyond your reach; others will fly rather low and somewhat heavily, giving you favourable opportunities to try your skill with the net; others, again, will fly only a yard or so, and alight on a neighbouring leaf, often remaining so quiet that the killing bottle is easily made to inclose them.

There are moths that show a decided preference for large trees. These may be seen hovering about high branches during the evening twilight, and sometimes even in sunshine. In many such cases the chance of a capture seems hopeless, but occasionally one will descend so low that a watchful collector is able to secure it by a sweep of the net.

If at any time you are in a locality by day where you suspect the presence of certain species of moths at rest among the upper branches of trees, such branches should be beaten if possible to dislodge the insects they may shelter. A long stick will often serve this purpose well, and, failing this, a few stones thrown among the branches may prove effectual. In the case of small and rather slender trees, a kick against the trunk will set the whole in vibration sufficient to surprise all the lodgers; and the same effect may be produced with larger trees by giving each a good sound blow with a mallet or some other suitable implement.

This or any other plan of 'beating' for moths is much more conveniently worked by two collectors together than by one alone; for one engaged in beating the herbage cannot be at the same time fully on the alert with the net. If two persons are together, one may take the lead, armed with the beating stick only, while the other, only very slightly in the rear, is always ready to strike.

We have said that butterflies should always be killed in the field, but this plan is not so universally adopted with moths. Many collectors carry a large supply of pill boxes when going out for the latter and then take as many as they possibly can by boxing them direct in these. This method of 'pill-boxing' is very simple in the case of the lazy and soundly sleeping moths. It is only necessary to hold the open box below the insect, and then cause it to fall by pressing the lid down gently on it from above.

Many of the moths so caught will remain quiet in the boxes and can be taken home alive without much fear of damage. All may then be killed at the same time by packing all the pill boxes in some vessel of sufficient accommodation, and shutting them in with a little chloroform, ammonia, benzole, or other suitable poison. The vapour will soon find its way through the pores of the pill boxes, but, in order to make its action speedy, each one should have a few perforations in the lid.

Whatever advantages this method may give to the collector who works at night, when the process of pinning would be more or less tedious, there is no necessity for its adoption during the day. The large number of pill boxes required is certainly far more bulky than the single collecting box that would accommodate all the day's captures; and although most of the insects boxed alive may be none the worse for the shaking they get, and may not damage themselves by fluttering in their small prisons, yet there is often a little loss on this score.

If you do adopt the pill-boxing method, be very careful that you do not mix the occupied boxes with the empties; and unless you fix on some definite plan for the prevention of such an occurrence, you will often find yourself releasing a prisoner from a box you have just opened to receive a new-comer.

Suppose that you start with all your empties in your right pocket. Then each one, as soon as it is tenanted, might be placed in the *left*, with the name of the insect, or any particular concerning it you would wish to note, pencilled on the lid.

When examining the trunks of trees you will be continually meeting with specimens of very small Moths (*Pyralides*, *Crambi*, *Tortrices*, and *Tineæ*) and at first may find some difficulty in boxing or bottling such small and delicate creatures. A grass stalk will enable you to tip some of them into your killing bottle, but some are so snugly packed in crevices of the bark that it is almost impossible to get them out without damage, even with a thin and [illegible] [illegible]. [illegible] [illegible] [illegible] of [illegible] in your mouth [illegible] [illegible] them and blow them into your net, and [illegible] they are easily transferred to a box or bottle.

These few hints will prove sufficient to start you on moth-hunting expeditions during the daytime, and will enable you to make good use of the dull days and cloudy hours when the butterflies are quiet; but we must now turn our attention to the night work of the entomologist, and see how we may attract and catch moths during their hours of work and play.

Searching for Moths at Night.

It is a well-known fact that the night-flying moths are attracted by lights, a characteristic of these insects that it is difficult to explain. Their love of darkness is in many instances so decided that they absolutely refuse to take flight while the fading light of day still lingers on the horizon, and even display a great aversion to the rays of the moon; and yet these very same species will often rush madly into the fierce glare of a naked artificial light, or fly with an energy almost amounting to fury against the glass of a street lamp or lighted window.

Puzzling as this peculiar tendency is, we can profitably turn it to our own account by making it a means of luring a number of moths into our presence.

The simplest way of putting this mode of capture into effect is to post yourself at your open window, with net and cyanide bottle at hand, while the brightest light you can command casts its rays as far and as wide as possible into darkness outside. If you use an oil lamp for the purpose, let it stand just inside the window frame, or, if a jointed gas bracket happens to be situated beside the window, bend it round so that the rays may pass over a wide area outside.

Two such lights are sometimes a very decided advantage—one quite outside the window to attract the moths from all possible points, and then another near the middle of the room to invite them inside. Whether you use either one or two lights, always see that it or they are so surrounded by a screen that the moths cannot by any possibility rush into the flame. There is nothing better for this purpose than a covering of light gauze, for this is not only a barrier for the prevention of the suicidal tendencies of the insects, but it also gives a good foothold to those who would like to rest and enjoy the luminous feast.

You will soon begin to learn that moths, like ourselves, exhibit great differences in their ways of enjoying their festal moments.

Some will satisfy themselves by flying *near* the light in almost a straight course, hardly slackening their speed as they pass, or will, perhaps, make a hurried curve round the light and then pass on at once about other business. To catch these you must be always on the alert, with net in hand, ready to make a dash at the right moment. But many will make straight for the flame, and then, finding a barrier in the form of gauze or glass, will either flutter round and round as if dissatisfied with your attempt to save them from an untimely end, or else settle quietly on the screen to enjoy the brightness for a long period. The flutterers are usually easily covered by a glass or the open cyanide bottle, and as for those that settle down quietly, you can take them at your leisure.

It will not do for a collector to depend solely on this method of obtaining moths, but at times when either his duties or the bad weather keeps him at home it affords him a means of capturing a few specimens that otherwise would have been missed. He may be even so busily engaged in other matters that he cannot afford the time to stand and watch with net in hand, but the insects that fly into his room and dance round the gas jet or inquisitively examine the white surface of the ceiling are easily netted or boxed without much loss of time.

The chances of success at this kind of work will vary considerably with the aspect, the season, and the weather. If your window opens on a large flower or fruit garden, on a patch of wooded country with plenty of underwood, a piece of waste ground overgrown with rank vegetation, or a stretch of heath or moor, then you may expect a very large number of visitors; but if you are situated on a level and barren country, or in the dense atmosphere of a thickly populated district, you must not reckon on many intruders.

As regards the season, this is more extended than that of the butterflies. A few species of moths may give you a call during the bleak nights of October and November, and also during the somewhat less dismal nights of February and March; but from April to September you may rely on a goodly number of captures. Of course you will not expect many of the 'rarities' and 'gems' to find you out; these are to be searched for in the open field or the [illegible] previously described; but your lights will attract a large [illegible] especially [illegible] and Noctuæ, the former [illegible] during the early summer, and the latter more or less throughout the season.

A little experience will show you that the atmospheric conditions form a very important consideration. The dark and warm nights are the most productive. Very little luck is to be anticipated when the full moon is throwing down her silvery rays from a clear sky ; nor will you see many while a cold east or north-east wind is blowing. Under these conditions many moths prefer to keep in the sheltered nooks where they slept away the sunny hours of the day. They love a warm and moist air such as calls forth the odours of the fragrant blossoms that provide their sweets, and show no dislike to a fine drizzling rain that you yourself would prefer to avoid. A pelting shower will generally keep them under cover, but they delight in the fresh and moist air that immediately succeeds the passing storm.

If you reside on the outskirts of a town an occasional tour of inspection of street lamps may add a few specimens to your collection, and some entomologists attach so much importance to the value of these luminaries that they provide themselves with a special net for the removal of moths from the glass and rails (fig. 50). The straight side marked *a* is applied to the panes of glass when flutterers or settlers are to be taken, and the bend on the opposite side is to secure those that rest on the rail. Such a frame is easily made by bending a piece of stout wire to the required shape, and then soldering it to a ferrule to receive a long stick. The net itself should not be deep.

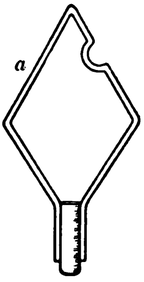

FIG. 50. — FRAME OF NET FOR COLLECTING INSECTS ON LAMPS AND WINDOWS.

Many different forms of traps are now made for catching moths, and these are deservedly coming rapidly into favour. They are generally constructed on a 'catch-'em-alive-oh' principle, and have the advantage that, after having been set, they may be left alone all night without any watching, and give an ambitious collector the opportunity of taking insects in his garden and searching in the open field both at the same time.

One of these traps may be constructed as follows at the cost of only a few pence over the price of a small paraffin lamp. Put together a square box, the sides about two feet and the front open, or procure a suitable one from your grocer. Place a paraffin lamp with a bright tin reflector at the back of this, and make a hole in the top just over the chimney to allow the heated air to pass out freely. Three sheets of glass are now to be placed as shown in the sketch (fig. 51), one upright piece completely shutting off the lamp, and two others placed obliquely with a space between them just large enough to allow admission. These must be exactly the width of the box, and should not be permanently fixed, but simply resting on small wooden supports nailed on to the sides. When required for use, it is only necessary to light up the lamp, strew some dead leaves on the bottom of the box, and put the sheets in their places. It will be seen at once that the angles at which they are placed will direct all light-seekers into the lower compartment, whence they are not at all likely to find their way out again; and after vain endeavours to reach the light they finally settle down on the sides of the box or seek shelter among the dead leaves.

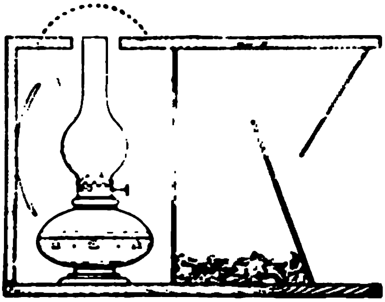

FIG. 51.—A TRAP FOR CATCHING MOTHS.

Occasionally it happens that an entomologist is lucky enough to claim the friendship of a person who, from the nature of his calling, is peculiarly well qualified to render him great assistance. Thus a friendly lamp lighter, expert and patient in the use of the cyanide bottle or pill box, is capable of giving valuable and at times; and the keeper of a lighthouse has it in his power to capture many a gem that is seldom seen on the wing; but, although much may be done by means of these and other stationary lights, this kind of work does not compare favourably with the night rambles of a naturalist in the very haunts of the objects of his search.

For such outdoor work in search of moths a good lantern is essential. An ordinary bull's-eye is almost useless, for, although it concentrates a good light on certain objects, the narrow range of its rays is [illegible] objection to its use for entomological work. [illegible] purposes it is necessary that the rays of light [illegible] but also shoot off right and left [illegible] very [illegible] before it is too late to wield the net. This [illegible] obtained by means of three flat glass sides, [illegible] plate glass front.

In addition to this you must go out provided with your net, killing bottle, and a number of pill boxes. Choose your night according to the hints already given, and if you are on the look-out for any particular species, be careful that the date of your outing is well timed, making any necessary allowances for the forwardness or backwardness of the season, for a moth that is generally due on a certain *average* time of the year may appear some weeks sooner if the preceding weeks have been unusually warm, or its emergence may be delayed considerably by the prevalence of cold east winds or a late frost.

Make up your mind as to the field of your operations before you start, and if possible choose a route that will carry you through a variety of situations, so that you may pass the favourite haunts of a number of different species. Clearings in woods with an abundant undergrowth, waste places with plenty of tall and rank vegetation, overgrown railway banks, clover fields, the flowery borders of corn fields, plantations in parks, heaths and moors, sheltered and overgrown hollows such as chalk pits and old disused quarries, reed and marsh land, all these are good localities, each one inhabited by its own peculiar species, and if your route runs through a fair variety of such places you may, other things being equally favourable, depend on a good catch.

See that your time also is well chosen. Of course you cannot say exactly what the night will be till it actually comes, and, as you have to start off before it is dark, you must consider the probabilities of the future from the present condition of the air. Let it be a night when a bright moon is not due, and if it follow a warm and moist day with a south or south-west wind, or if drizzly, so much the better; but let your feet be shod with boots that will permit you to wade through moist herbage without danger, and take a waterproof if necessary.

It is always advisable to be on your hunting ground before twilight sets in, as a number of moths venture out before the sun has disappeared; and then you can work on till midnight if you feel inclined, or even extend your labours till the early hours of the morning.

Before dusk you will meet with many of the little *Tortrices* (page 298) in sheltered spots, and a little later the *Geometræ* and Hawks will be on the wing. Thus, before dark, you may make good use of your net, dealing with your captures just in the same way as recommended in the case of butterflies.

After a time, however, the lantern will have to be brought to your assistance in making known the whereabouts of the later species, consisting chiefly of the *Noctuæ*, many of which do not make their appearance till it is quite dark. If now you carry your lantern in your left hand, your work will be rendered somewhat difficult and tedious, for, although one hand is sufficient to manage the net properly, you are compelled to rest your light on the ground every time you make a capture, as it is impossible to box your specimens unless both hands are quite free. This difficulty is easily overcome by suspending the lantern by means of a string or strap placed round your neck, allowing it to hang on your chest; and a further advantage is gained by having a second strap round your chest to prevent it from swaying about with every movement of your body. This arrangement gives you both hands perfectly free during the whole time, and also prevents the necessity of continually bringing yourself into a stooping or kneeling posture while you are examining or boxing the specimens you have netted.

There are now two courses open to you. Either you can kill and pin the moths as you catch them, fixing each one securely in the collecting box, or you may simply shut each one in a separate pill box and leave the remainder of the work to be done at home. If the ordinary collecting box only is used, a little of your time is necessarily occupied in pinning and transferring, and if many insects are about such an occupation may appear to you to be a waste of valuable time. But this is not all. Often and often will you find that while thus engaged a splendid moth will come and flutter round your light; and, before you have time to drop your collecting box and pick up the net, the fine creature you would have prized has darted off again. This certainly seems to speak in favour of the pill boxing method, but it must be remembered that a few of the moths will continue to flutter after they have been boxed, so that when you arrive home they are more or less damaged [illegible] the scales that once adorned the wings now lying [illegible] of the boxes. Perhaps the best plan is to take [illegible] the collecting box and also a quantity of pill boxes [illegible] which is the [illegible]

[illegible] be put [illegible] such are [illegible] in spring [illegible] should be carefully and frequently watched, and at other times the blossoms of heather, ragwort, bramble, clover, and various other flowers must be searched.

As you cast the rays of the lantern on the feasting moths some will prove themselves very wary, and dart away at your approach; but others will take but little notice of your advance, and will continue to suck the sweet nectar, their eyes glaring like living sparks.

As a rule the *Noctuæ* thus engaged are easily pill-boxed or caught direct in the cyanide bottle; but a few of the more restless species are to be made sure of only by a sweep of the net. Some will feign death as soon as disturbed, and allow themselves to drop among the foliage, where further search is generally fruitless.

Another common difficulty arises from the inconvenient height of many of the attractive blossoms—often so great that it is impossible to reach them with the net, and very difficult to direct the rays of your lantern on them. This is particularly the case with sallow and ivy, the flowers of which are two rich sources of supply to the entomologist.

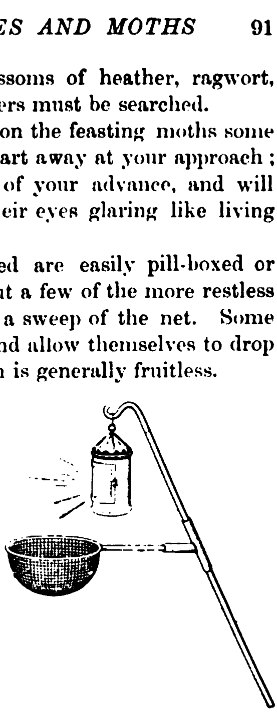

Fig. 53.—Net and Lantern for Taking Moths from High Blossoms.

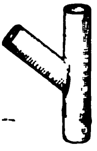

Fig. 52.

Those who intend giving special attention to these blossoms should be provided with some form of apparatus that will enable them to extend their operations as high as possible. Perhaps the most effective arrangement is the well-known combination here figured. It consists of a long and stout stick, at the top of which is a tubular joint (fig. 52) that might be termed a T-piece were it not that the smaller part does not stand out at right angles to the other. In this is fixed, in a straight line with the stick, a short rod on which hangs a lantern—an ordinary bull's-eye answers well here; and in the smaller tube is another short rod carrying a shallow basin-shaped net, and of such a length that the net is just in advance of the lantern.

At first sight this arrangement will strike you as being very unsatisfactory, there being no kind of trap to prevent the escape of the insects. But it must be remembered that moths are more or less addicted to habits of intemperance—that they will hold on to the supply of the sweet fluid they enjoy till they are ready to drop with intoxication. This being the case, some will fall into your net as soon as they are startled by the sudden and near approach of the glare of your lamp, and others are easily *made* to fall therein by gently tapping the flower-bearing stems from below with the edge of the ring.

Having become acquainted with this very sad propensity, which thus brings ruin to so many unfortunate moths, can we not yet further turn their evil doings to our own profit in our endeavours to become acquainted with their structure and history? Most certainly we can. All we have to do is to distribute in their haunts a bountiful supply of some artificial intoxicant such as they love, and then lie in wait for the victims that fall a prey to our snare. This process is known to entomologists as 'sugaring,' and is a splendid means of securing an abundance of species, often including some rare ones that are scarcely to be obtained by any other plan. Let us now inquire into the *modus operandi* of this interesting operation.

The first thing to do is to prepare the luring sweetmeat. Supply yourself with a quantity of strong, dark treacle, and also some dark brown sugar; always remembering, in the selection of these viands, that odour rather than purity is to be the guide. The best kinds of sugar are those very dark and moist brands imported in a raw state from the West Indies, nothing being better than that known as 'Jamaica Foots.'

Mix about equal quantities of these with a little stale beer, and boil and stir till all the sugar is dissolved. The consistency of the mixture should be such that it will work well with a brush when used as a paint—not too thick, nor so thin that it is easily absorbed by the substance on which it is 'painted,' nor must it be in such a fluid condition that it easily runs.

When satisfied on these points, transfer the mixture to a tin canister, see it properly covered, and set it aside as your 'stock' from which you can draw supplies as required. Now secure an ordinary painter's brush of convenient size, and a number of strips of [illegible] which is fastened to a hook formed of bent wire. [illegible] together with the usual lantern, collecting box, pill boxes, and killing bottle, complete your outfit for the sugaring expedition.

When the selected time for operations has arrived, take officient 'sugar' for your night's work, mix it well with sufficient strong rum to give it a very decided odour, and start off at dusk with this and the other requisites just mentioned.

The night chosen should be warm and calm, with a rather damp atmosphere, and no moon preferred. Let your locality be a well-wooded one; abounding, if possible, with giant oaks and other trees, and containing open spaces with plenty of underwood and rank herbage. Such localities are to be met with at their best in forest lands, and if you would do wonders at sugaring you cannot do better than arrange for spending your holidays in such a spot as the New Forest, taking with you sufficient 'sugar' for several nights' work.

Having reached a likely spot of no very great extent, you prepare for real work. Light up the lamp, and get out your sugaring tin and brush ready for action. Take your course along some definite track that you are sure to remember, painting vertical strips of sugar, about a foot long, on the trunks of trees or on palings, and hanging strips of rag that have just been steeped in the sugar on the branches of small trees and shrubs where you do not find good surfaces for the brush.

After satisfying yourself concerning the amount of sugar distributed, retrace your steps, examining every patch of sugar as you go. It will not be long before signs of life appear. Earwigs, spiders, centipedes and slugs will soon search out the luscious feast, but unless the time and the locality are ill chosen, the lantern will soon reveal a goodly number of moths, with eyes glaring like little balls of fire, greedily devouring the bounteous repast. These will consist chiefly of *Noctuæ*, but *Sphinges*, *Geometræ*, and numerous small species also join the company.

Some will exhibit a restless disposition, either darting off before you make a close approach, or keeping their wings in rapid vibration as if to be fully prepared for a hasty retreat when occasion demands. These must receive your attention first; and, having secured them, proceed to box as many as you require of the more lazy and gluttonous species.

As a rule, moths thus engaged are easily pill-boxed, but the livelier ones will not submit to such treatment without attempting to escape. The best way to secure these is either to cover them with the opened cyanide bottle (or its substitute), and replace the cork as soon as a favourable opportunity occurs; or to perform the same feat with a glass-bottomed pill box.

The advantage of the latter over the ordinary boxes will be seen at once. After the insect is covered, its movements can be watched, and so a favourable opportunity can be seized for snapping on the lid.

As already stated, some moths feign death when in danger, allowing themselves to fall in places where they are often quite safe from capture. Others allow themselves to fall simply because they have so gorged themselves with the intoxicating sweet that they can no longer maintain their hold. Both these classes of sugar seekers may easily be secured by means of a net commonly known as the 'sugaring net.'

This implement is so simple in its construction that anyone can easily make his own. The frame may consist of two straight wires or canes fixed in a metal Y, and the other ends joined by a piece of strong string or catgut as shown in fig. 54. The net itself need not be deep. As soon as you reach a tree where moths are feeding on the sugar, press the string of the net against the bark just below them. The string at once assumes the form of the trunk so well that you may be sure of every insect that falls while you are boxing.

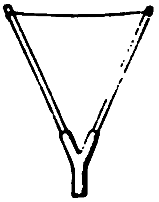

FIG. 54. FRAME FOR THE SUGARING NET.

For this work both hands must be free, and this is easily managed in spite of the number of appliances called into service. The lantern is slung round your neck and secured by a strap round the chest. The 'sugaring net' has a very short stick, and just while you are engaged in boxing specimens, it may be gently held against the trunk by a slight pressure of the body. But such precautions as these are necessary only when the night worker is out alone. There are many circumstances, however, that render the work of two or more in company much more enjoyable than that of a single-handed entomologist. The labours are considerably expedited where a division enables each one of the night ramblers to take a particular portion of the work; and if there is such a person as a nervous entomologist, that individual should on no account go a sugaring in lonely spots on dark nights. Every rustling leaf [illegible] one [illegible]; all footsteps are those of approaching [illegible] the peace; and when at last the invisible landowner or his keeper, [illegible] movements of the lamp, greets him with [illegible] 'What are you doing here?' then for the moment he forgets his enchanting [illegible] and wishes he were safely at home.

It is certainly advisable to take a friend, whether an entomologist or not, on such expeditions; and if you intend working on private grounds, always make previous arrangements with the property owner, that you may fear no foes and dread no surprises; for a sugarer is far more sure of success in his work if he keeps a cool head and has nothing to think about for the time being but his moths and his boxes.

A few hours at this interesting employment pass away very rapidly, and when midnight arrives there is often no great desire to leave off, especially when it is known that some species of moths are not very busy till very late at night. Still it is not advisable to surfeit oneself with even the sweets of life. Perhaps it is better as a rule to work the early species only on one night, and reserve another for the later ones. The searchings are then always carried on with vigour throughout, and the labours that are thus never made laborious ever retain their attractiveness in the future.

It has often been observed that, when sugaring has been carried on for a few successive nights in the same locality, the success is greater each night than on the one preceding it. Hence it is a common practice to work a chosen 'run' for two, three, or more nights in succession; and some collectors even go so far as to lay on the bait for a night or two previous to starting work. For the same reason it is often advisable to continue the use of a fairly productive beat rather than to wander in search of a new one.

In the neighbourhood of large towns one may often meet with patches of sugared bark that mark the course and extent of a brother entomologist's beat, and such are valuable to an inexperienced amateur in that they give him some idea of the nature of the localities that are chosen by more expert collectors. But it must be remembered that each entomologist has a moral right to a run he has baited, and that it is considered ungentlemanly, if not unjust, to take insects from sugar laid by another. I have sometimes seen cards, bearing the names of the collectors and the date of working, tacked on to baited trees and fences, thus establishing their temporary exclusive rights to the use of their runs. Such precautions are not necessary in large tracts of forest land, where the choice of runs is practically unlimited.

There are two other modes of capture available to the moth collector—the use of decoy females, and the employment of 'sugar traps'—and both these may be used on the sugaring run, or at other times either in the woods or in your own garden.

The wonderful acuteness of the sense by which the males of certain species are enabled to seek out the females has already been alluded to, and the possession of a suitable decoy will often bring you a number of beautiful admirers without the least trouble, except that taken in securing the decoy and preparing her temporary abode. It is absolutely necessary that the female moth be one that has recently emerged, and consequently you had better secure her in one of her earlier stages, either by previous rearing or by collecting the pupæ.

A little cage composed of a framework of wire covered with gauze must now be made. Perhaps the simplest pattern is that illustrated. Here the gauze is attached to two wire rings, only a few inches in diameter, and suspended by a string. Such a cage answers every purpose in the field, and has the advantage of folding into an exceedingly small space when not in use. It may be suspended in your garden or taken into the field whenever you have a suitable decoy at your disposal.

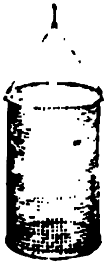
FIG. 55. CAGE FOR DECOY FEMALES.

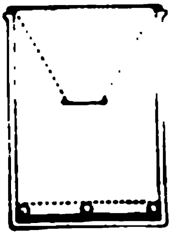
FIG. 56. A SUGAR TRAP.

The sugar trap may be of much the same pattern as that in which a light is used, but if intended for field work it should be of a convenient size for portability. A lighter and far more convenient form may be constructed as follows.

I[illegible] tin box, and [illegible] piece of [illegible] enough to drop [illegible] it. Then make two [illegible] than the [illegible] the other [illegible] Next [illegible] of [illegible] two [illegible] of its two extremities. When the trap is required for use, cut a circular piece of flannel or other absorbent, steep it in sugar that has just been flavoured with rum, and place it in the bottom of the tin. Then place a few pebbles of equal size around the sides to support the zinc partition, drop in the partition, and then allow the net to hang on the rim as shown in the sketch.

This arrangement will explain itself. The moths, attracted by the sweet perfume, flutter about in the net till at last they find their way through the small ring. Once in, they make further attempts to reach the sugar; and, at last, finding all efforts fruitless, and, like Paddy at the fair, not being able to dicover the 'entrance out,' they finally settle down in a disappointed mood awaiting your pleasure.

Perhaps another word of explanation is necessary here. Why not allow the poor creatures to reach the sugar that attracted them to the spot? The reason is this. They sometimes gorge themselves to such an extent that their bodies, dilated to the fullest capacity with syrup, are a bit troublesome when the insects are placed in the cabinet. It is therefore advisable to see that the zinc is so far above the sugar that the moths are unable to reach the latter by thrusting their extended proboscides through the perforations. A few dead leaves scattered on the zinc is also a useful addition, since it affords shelter to such of the insects as prefer it.

This is a very useful trap to keep in one's garden throughout the season. It may not attract large numbers, but it has the advantage that it requires no watching. It is simply necessary to set it at dusk, and remove the captives in the morning or at your leisure.

CHAPTER VII

COLLECTING OVA, LARVÆ, AND PUPÆ

We have already observed that insects should, as a rule, be set as soon as possible after their capture; and it would therefore seem that this is the proper place for instructions in this part of the work. But it so happens that butterflies and moths are to be obtained by means other than those already described, and we shall therefore consider these previous to the study of the various processes connected with the setting and preserving of our specimens.

Were we to confine our attention to the capture of the perfect forms only, our knowledge of the *Lepidoptera* would be scanty indeed, for we should then be ignorant of the earlier stages of the creatures' lives, and have no opportunity of witnessing the wonderful transformations through which they have to pass.

Such an imperfect acquaintance with butterflies and moths will, I hope, not satisfy the readers of these pages; so it is intended, in the next two chapters, to give a little assistance to those who would like to know how to set to work at the collection of their eggs and larvæ, how to search for the pupæ, and how to rear the insects from the stage at which they are acquired till they finally emerge in the perfect form.

These portions of an entomologist's work certainly take up a great deal of his time, and also require much patience and perseverance; but the advantages derived cannot be over-estimated, for in addition to the knowledge gained of the early stages of insect life, this kind of work will enable him to place in his cabinet a number of gems he would otherwise have not and probably know not. Occasionally a prize may be obtained in the form of a cluster of eggs [illegible] of a rare species; in many instances the larvæ are to be obtained with comparative ease, while the perfect insects of the same species are not often seen or not easily captured, and many a rare pupa has been dug out of its hiding place during a season when the entomologist had but little other work to occupy his time.

These and other similar subjects we shall now consider in turn.

Collecting Ova

The collection of ova may be carried on more or less throughout the year. A number of moths are out in February, and even in January if the weather is mild. These soon lay their eggs, which are hatched about the time that the buds of the food plant are breaking. From this time till late in the summer the ova of various species are being deposited, the average period from laying to hatching being from two to three weeks. Then, during the autumn, when the leaves of food plants are turning brown and crisp, ova are still being laid, but these remain unchanged till the new buds of the following spring are bursting.

Of course if you intend searching for the ova of particular species you must previously ascertain the favourite haunts of those species, become acquainted with their food plants, and also with the season or seasons during which the eggs are laid. But the few following hints will suffice as general instructions for the search.

In nearly all cases we must expect to find ova on the food plants of the respective species, but at times, especially with certain moths, we may come across them in the most unlikely spots. Thus, it sometimes happens that a moth settles on a street lamp, and lays her eggs on the framework round the glass, or even on the glass itself. The same thing may take place on the sash or glass of a brightly lighted window.

Such occurrences, however, we must regard as accidental and comparatively rare, and therefore we confine our searchings for ova to the food plants of the species we require.

As a rule the under sides of the leaves will yield the most, but we have already noticed (page 18) that some moths leave their eggs exposed on the upper surface. Again, some larvæ feed on flowers and seeds and fruit, and the eggs of such are deposited on these parts. Those insects which feed on the leaves of shrubs and trees often lay their eggs on trunks, branches and twigs. Sometimes these are laid singly, sometimes in dense clusters; and it is not unusual to find them arranged in rings or spirals with great regularity. When examining the trunks of trees for ova it is necessary to look well into the crevices of the bark, for some insects take particular care to lay them in deep sheltered chinks; but others take no such precautions, and deposit them on exposed ridges or plain surfaces where they are easily discovered.

One difficulty of the ova collector lies in the fact that many insects lay on the upper branches of large trees. Of course a search for these is out of the question; but in places where the trees have been cut down a few years previously, and where a consequent undergrowth has developed, there are considerable chances of success with these species. Young saplings of trees often yield well, especially in places where tall trees of the same species are absent. It may be mentioned, too, that some moths (page 294) actually lay their eggs beneath the surface of water, depositing them on the under surfaces of floating pond weeds, and others (page 298) even enter the nests of wasps and bees for the same purpose. It is clear, then, from these few remarks, that the work of an ambitious collector of insects' eggs is by no means a monotonous task; for his employment takes him into the meadows and woods, leads him to the banks of ponds, and even compels him to tear down banks and hedges for the nests of *Hymenoptera* at the risk of a sting or two.

One of the most productive sources of eggs is undoubtedly the possession of captured females. When you are out netting butterflies you often see a female that is evidently engaged in her matronly duties. Instead of seeking food from the various flowers in her path, she pays attention only to the foliage, looking out a suitable leaf on which to deposit her eggs. Should you meet with an insect thus engaged which you would like to rear at home, or of which you would like to know the egg, secure it in a perforated pill box with a leaf of the proper plant; and it will often supply you with abundance of eggs for your purpose, in many cases depositing them in the box before you arrive home. The eggs of numerous species of moths are also to be easily obtained from captured females.

Some insects do not seem inclined to deposit their eggs in captivity so freely as when at large, and in order to induce them to do so we must, as far as possible, put them in their natural conditions. Let them have plenty of room and supply them with fresh foliage of their food plant, kept green by standing them in vessels of water. It [illegible] [illegible] supposing you are not well acquainted with the habits of the species you have, to keep a portion of the box well shaded from direct sunlight, and allow another part to be as bright as possible; for some species will not lay in a bright light, while others will not do so without it.

Again, while some deposit their eggs within a few hours of quitting the pupa case, others do not lay for several days. With regard to the latter, it is frequently necessary to feed them while in captivity, by placing in the box a piece of rag or sponge that has been dipped in honey or syrup.

Each batch of ova should be carefully examined with a view to knowing them by sight on a future occasion. A sketch should be made in your note book, showing every detail that you can make out with the aid of a good lens. Then observations concerning the season, colour of the eggs, the situation in which deposited, arrangement, and any other useful particulars, should be entered.

In the next chapter some hints will be given concerning the management of ova and the rearing of the larvæ from the time of hatching.

Collecting Larvæ

This occupation is generally far more productive to the entomologist than searching for ova. The latter are very small, usually well concealed, and to be detected only by a careful scrutinising use of the eyes; but the superior size of the larvæ, the frequent bright colouring, and the fact that they are easily beaten from their hold, render the searchings of their hunters comparatively easy and fruitful.

Before setting out on a larva-hunting expedition, there are a few requisites to prepare. These include not only the implements for your work in the field, but also the cages in which you intend to rear your little captives. The latter are described a little later on under the head 'Rearing Lepidoptera,' and the former we will now briefly summarise.

The outfit must consist of a quantity of suitable boxes, a stout hooked stick, a strong net, and a white material to place under the herbage while you are 'beating.'

'Larva boxes' are usually made of zinc, and have little sliding doors in the lids, so that the lids need not be removed while out of doors after the fragment of the required food plant has been inserted. Such boxes are not by any means essential. Small tin boxes will answer all purposes nearly as well, providing a number of small holes be made in them for the admission of air. Chip boxes are also fairly satisfactory, but these also should be perforated. The best way to do this is to push a red hot iron wire through the chip, making about half a dozen small holes in each box. This method will give you clean holes of a uniform size without otherwise injuring the boxes.

Metal boxes possess the advantage that they keep the food plants moist for a long time, while chip boxes allow them to dry rather rapidly. Yet there are some larvæ that do far better in the latter, since such a quantity of moisture exudes through their skins that they soon become uncomfortably wet if their apartment is not well ventilated. Under these circumstances perhaps it is better to take a supply of both, so that changes may be made as found necessary.

One grave objection to chip boxes, however, is the weakness of the material. They are easily crushed by pressure, and a bottom or a top disc of wood often falls out; but this is easily overcome by gluing narrow strips of calico round the top and bottom edges. Chip boxes should always be treated in this way, and they will then last five or six times as long.

Your supply of boxes should always include one large one of metal in which to bring home a supply of food for the larvæ. If you have a botanist's vasculum, by all means take it, for nothing can serve this purpose better. If not, any rather large square tin box will do, and this may be carried in your satchel, or a couple of hooks may be soldered to it so that a leather strap can be fixed for slinging it over your shoulder.

The net required is that commonly known as the 'sweep net.' It must be very strong, for it has to submit to rather rough usage. The frame must be made of thick wire; and the bag, which need not be more than a foot deep, should be of strong calico or holland.

Now with regard to the white material previously mentioned. This may be a square of calico, hemmed round the edges. Nothing is more convenient than this, as it occupies but little room in the pocket when not in use, if neatly folded. The material need not be thick, but the larger it is the better. Many prefer a white umbrella or an ordinary umbrella with a white lining, but as this is only a matter of taste and convenience you must decide for yourself as to which you will use.

If your field of operations is only a little way from your head quarters, and quantity of luggage therefore not a serious consideration, you may provide yourself with a heavy mallet, loaded if necessary with a pound or two of lead. This will prove very useful in shaking larvæ from trees and large branches. Lastly, take a pencil and a note book or writing paper for your observations in the field.

Now for the choice of the season. Larvæ are to be found all the year round. Early in the spring, as soon as the buds are bursting, some break out of the eggs recently laid by the moths that appear in February and March. Later on, during April and May, a host of both butterflies and moths are busy arranging for their broods. Then, throughout the whole of the summer, thousands of caterpillars of all sorts and sizes are to be met with everywhere. And finally, during the bleak winter months, you may amuse yourself by digging the hybernators out of their hiding places where they rest themselves till the spring sun again calls them out to refresh them with the young and tender leaves of a new year. Thus, unless you are merely intending to search out certain species you happen to require, there is not much difficulty in settling on the season.

The day selected should be dry, for your work lies among the herbage of banks, meadows, and woods, and nothing is more unpleasant than wading through a wet and dense vegetation, or beating down on yourself a shower of large drops from the branches of trees and shrubs.

Having reached the hunting ground, the first thing to do is to look out for *signs* of the presence of larvæ rather than for the larvæ themselves. Healthy vegetation with sound leaves must be passed by as untenanted; but the presence of partly eaten foliage immediately arouses suspicion.

A little experience will soon enable you to distinguish between the ravages of larvæ and of slugs, snails, wasps, &c. Some of the smaller larvæ certainly eat out clean holes like those cut by *Hymenopterous* insects, but as a rule they bite away at the edges, leaving the midrib and the larger veins standing out almost naked.

By looking well into the edges of the eaten leaves, it is easy to see whether the marauders have been recently at work. If they are dried up and discoloured, it is not of much use to search; but if still green and moist, you may feel almost sure that the hungry larvæ are not far off.

In this case you will carefully turn over the leaves to examine the under sides, and also the leaf stalks and branches or stems; but you must be prepared for all kinds of protective mimicry. Little green caterpillars will be seen lying on the midrib or veins, so straight and so still that they are scarcely perceptible. Others are snugly tucked in a depression of a leaf with the same result. Then we must also be prepared for the artful little tricks of the larvæ of *Geometræ* (p. 268), by which they imitate stalks and twigs so closely that a sharp eye is necessary to discriminate between the two.

While thus searching we may meet with the cast skin of a caterpillar. This gives us fresh hopes, and so we continue our careful examination. At last, on grasping a leaf in order to turn it over for inspection, we feel something hairy or something soft and smooth. But lo! it is gone. It is one of those numerous caterpillars that feign death and drop to the ground on the slightest sign of danger. We search below for it, but the density of the vegetation renders this hopeless, and we are just about to start off in search of a more productive locality when we espy a quantity of the excrement of larvæ lying on a little bare patch of ground close by. This gives us a new idea. Here is another indication of the presence of the creatures we require, one that we can put into practice; and by-and-by we learn that in many cases this is really the surest sign of their whereabouts.

We look at these little pellets of excrement, and gain at once some idea of the *size* of the larvæ that produce them. Then we observe whether they are fresh and moist, or dry and stale. If the latter, it is not of much use to examine the leaves above; but if otherwise, there is little doubt of our meeting with larvæ, as the present position they occupy is so truly marked. The leaves just over them are carefully examined, either by turning them over as before described, or, if the height of the foliage admits of it, by placing our heads below and looking upward.

If we find that the larvæ are some of those that endeavour to escape by feigning death and allowing themselves to drop at the slightest disturbance, the net is always kept beneath the leaves we are touching in order to intercept them in their downward journey.

Continuing the search, we meet with leaves that are rolled up and bound with silk threads, and others that are drawn together and similarly bound. These are carefully uncurled and pulled asunder with the result that active little larvæ are exposed to view, or, it may be, pupæ are discovered. In some cases flowers are drawn together in just the same way, and an examination reveals one or more of the species that prefer petals and other parts of flowers to the green leaves.

Silken threads always arouse our suspicions. These may be seen lying on the surfaces of leaves, and passing from one leaf to another, or they may be hanging perpendicularly from the branches of trees above. In the latter case a larva may be frequently seen on the lower extremity of the fibre, swinging gently in the breeze, and, should we require it, we have only to place the open box below for its reception.

Hawthorn and other trees are sometimes seen almost devoid of leaves, nearly every bit of green having been greedily devoured by a host of small larvæ. In such cases we often meet with dense clusters of silk fibres that may easily be mistaken for spiders' nests. But when we look more closely into the structure we observe that we have discovered instead nests of gregarious larvæ, such a large number being in each little community that the deplorable appearance of the tree is at once explained.

A little farther on we meet with a sickly-looking plant in the midst of a number of flourishing individuals of the same species, and stop to make inquiries into the cause of this strange occurrence. Is it due to a poorness of the soil? No, this cannot be the case; for intermingled with its roots are those of its flourishing companions. We pluck a stunted and half-shrivelled leaf and examine it. At first we do not notice the cause of its peculiar condition; but, holding it up to the light, and looking *through* it, we see a number of little galleries that have been eaten out of its internal soft substance, leaving the thin skin (*epidermis*) almost entirely intact. But nothing more is to be seen. Another leaf is examined in exactly the same way; and here we see the little destroyer, lying motionless in its burrow till a gentle pressure applied against it from outside causes it to wriggle along its narrow passage. This is the larva of one of the little leaf miners mentioned again on page 303.

Reaching a little marshy spot we see a number of water-loving reeds, most of them beautifully green and in a flourishing condition, but here and there in their midst is a poor stunted specimen—another result of the ravages of the larvæ of one or more moths. An examination of the blades reveals nothing; but on splitting open the stalk we discover some larvæ that have already devoured a quantity of the internal pith, and thus endangered the life of the plant. On inspecting other similar reeds we are at first puzzled as to how the larvæ could get inside the stems without damaging the outer portion; but at last we see in each one a little discoloured hole that was eaten out by the young caterpillar just after its escape from the egg. Once within the reed, it found a plentiful supply of food, and there grew at the expense of the plant without doing any further external damage save by causing a stunted growth.

It may be that the stem eaters we have found are just about full grown. If so we examine a number of the stems with a hope that we may find one or two that are just about to change to the chrysalis state, or even a pupa already formed. By this means we may secure one of the perfect insects without the necessity of feeding larvæ at home. Such a consideration becomes a most important one when it happens that the required food plant is one that cannot be easily obtained.

Close by the reeds is another water-loving plant in the form of an old willow tree. This is always an attractive object to the entomologist, so it comes in for a share of our inspection. On its leaves we may find several species of the larvæ of *Lepidoptera*, including those of some of our largest insects. But a strange feature catches our eyes as we happen to glance at the bark of the tree. Here we see a few holes of different sizes, about which are a number of little fragments of wood that remind us of 'sawdust;' and, examining the ground below, we see quite a little heap of this dust, looking just as if a carpenter had been at work on the spot.

This is not the effect of a saw, however; it is a sure sign of the ravages of wood-eating larvæ (p. 224), whose powerful jaws gain them admittance into the very hearts of trees, and the application of the nose to one of the larger holes leaves no doubt of the presence of the large and beautiful caterpillar of the Goat Moth (p. 224).

If we require any of these wood-eaters, either for rearing or for preservation, we must be prepared for a little rather heavy work. A strong pocket knife is not sufficient, but with a good chisel the wood can be gradually cut away, and the galleries traced, till at last we come to the larvæ snugly resting in their burrows.

It often happens that the tree thus tenanted is half decayed, and consequently the work is rendered much easier. Also, while tearing away the wood, we often meet with a number of cocoons that have been constructed by the caterpillars for their winter quarters, or as a resting place while undergoing their transformations. These are composed of the wood dust bound together by strong silk fibres, and are often in such a good state of preservation that they form useful illustrations for the cabinet.

As further aids to larvæ searching we may mention that many species—chiefly of the *Noctuæ*—hide under the surface of the ground or among dense and low herbage during the day, and come out to feed only by night; that many others feed on roots, and are therefore seldom seen above the surface of the soil; also that a good number burrow into fruits, in the interior of which they spend the whole of their larval stage. The best way to secure the latter is to examine the 'windfalls' that lie scattered on orchard lands, for it is a well-known fact that the fruits that are infested with larvæ generally fall earlier than others—a result that must be attributed to the damaging work of the larvæ themselves.

All the larvæ collected should be carefully boxed at once, a separate compartment being used for each species, and a few fragments of the food plant being introduced in each case. It is also a good plan to have each box previously lined with moss as a further addition to the comfort of the captives. Without such a precaution some of the more delicate species are liable to injury during their transmission from field to home.

Hitherto we have obtained our larvæ by *searching* only, but there are times and occasions when our boxes may be far more rapidly filled by methods that are not such a tax on our time and patience. Suppose, for instance, that we reach a bush, the mutilated leaves of which seem to show that larvæ are present on its branches. We spread our white cloth or open out the white-lined umbrella just under a selected branch, and then tap that branch very smartly with our stick.

Down comes a host of living creatures! Spiders, larvæ, beetles, aphides, earwigs, and what not, struggling and running about on our white fabric in all directions, and all mingled with bits of stick, leaves, and fragments of all kinds. We leave the cloth or the umbrella, as the case may be, quite still for a few seconds to allow all the living creatures to get a good foothold, and then, raising it into a vertical position, allow all the rubbish to drop off.

We can now put the cloth down again, and select as many of the larvæ as we require, giving our first attention to the nimble runners and loopers that are already near the edge and just on the point of making their escape. This productive method of larva hunting is known as 'beating,' and is particularly applicable to tall herbs and the lower branches of trees and shrubs.

The same principle may be employed in the case of branches that are quite out of the reach of the stick, but the blows are here applied to the trunk, a mallet or some other rather heavy implement taking the place of the stick.

Another splendid method of securing larvæ where mere searching would be tedious and unproductive, lies in the use of the sweep net described on page 102. This implement comes into service in waste places that are covered with rank vegetation, in clover and hayfields, and in all spots covered with low herbs.

Walking among the vegetation, the net is swept right and left before you, and the contents examined at frequent intervals. It is advisable to work the different species of herbs separately as far as possible, otherwise there may be some difficulty in the determination of the food plants of the mixed larvæ that the net will contain. If, however, this plan is impracticable, you may save time by turning out all the 'sweepings' into one large box, leaving the sorting to be done at home in leisure hours.

Collecting Pupæ

We have seen that ova and larvæ may be obtained in greater or less abundance at all times of the year, so variable are the seasons of the different butterflies and moths. The same remark applies equally well to pupæ; but so many of the Lepidoptera spend the winter months in the chrysalis state that this period may be regarded as the harvest time of the pupa hunter.

A large number of caterpillars undergo their change to the quiescent state during the months of August and September, and, of course, remain in this state until the warm days of the following spring or summer. And as insects even in the pupal stage have a number of enemies and dangers to contend with, it is advisable to start your search for them as soon as possible after they have changed.

If you set your mind on searching for particular species, you should endeavour to ascertain the *usual* time at which such species pupate: make any necessary allowances for the forwardness or backwardness of the season, and then allow a week or two for the change to be completed, for insects should never be disturbed at times when their metamorphoses are in progress.

For general pupa hunting the best season is undoubtedly from the end of August to the end of October, but there is no reason why the work should not be carried on throughout the winter. If, however, you continue your work so late, you must not expect nearly as much success as time advances. You must remember that entomologists are not the only pupa hunters. Many hungry birds are always on the look-out for insects, and seem to enjoy them equally well in all their stages. Those that hybernate on or under the ground are liable to fall a prey to moles and beetles. In addition to these dangers, all pupæ are subject to the effects of extreme cold, dampness, or floods.

As regards the choice of a day, very little need be said. Any day that is sufficiently genial for yourself will do for your work, except that periods of hard frost render the ground too hard for digging—the most profitable part of the pupa hunter's task.

The apparatus required is extremely simple: A satchel or large pockets full of small metal or chip boxes, a small garden trowel, and a strong chisel.

If metal boxes are used they should be perforated; in fact, nothing is better than the ordinary larva boxes of the dealers. All the boxes, of whatever kind, should be lined with moss previous to starting work.

The trowel and chisel do not pack well with a number of small boxes, therefore it is a good plan to fix them in a couple of leather sheaths attached to your belt. In this position they are far more handy for use, and the boxes are also in less danger of being crushed or damaged, as they probably would be if in contact with hard and heavy tools.

A note book is also a valuable addition to your outfit, as it enables you to make memoranda concerning the trees and localities from which you obtain your pupæ.

The best localities for pupa hunting are clearings in woods, parks with numerous large timber trees, and meadows in which large isolated trees are scattered; and the best trees include willows, poplars, oaks, beeches, birches, elms, and hawthorns.

The best thing you can do on arriving at the selected hunting ground is to make at once for isolated trees of large size, and work each one as follows:

First examine well the crevices of the bark, for many caterpillars descend the tree to within a short distance of the ground, and then seek out a snug little crevice in which to spend the winter, often protecting themselves with silken cocoons, or constructing a neat little shelter of gnawed fragments of the wood cemented together.

If there is any loose bark, very carefully force it out with your chisel, and examine both its inner surface and the wood from which it was removed. The wood thus exposed may reveal openings of the galleries of wood-eating larvæ, in which case, unless the material is too hard to be broken up with the chisel, you may be able to trace out a few pupæ. Where these exist, they are usually to be found very near the entrance, sometimes even protruding slightly from the opening, for the larvæ generally place themselves in this position of easy escape when about to change.

Next give your attention to the moss, if any, covering the lower portion of the trunk. This affords a very favourite shelter to many species. Tear it off very carefully, beginning at the top, and watch for loose pupæ and cocoons as you do so. Then hold the clumps you have removed over a patch of bare ground or over a spread handkerchief, and pull it to pieces, in order that any pupæ it contains may fall out; also examine the fragments carefully for others that may remain attached.

This done, the surface of the ground must be examined. Remove all dead leaves, and watch for pupæ that may be sheltered beneath them. If any loose stones lie on the ground, turn them over. Search well into the angles between the roots, and if there are any holes or hollows beneath them or in the trunk itself, pull out all loose matter within, and *feel* gently above and around for cocoons.

After all loose matter has been removed, there still remains the soil for examination. If this is very hard and clayey, it is probably useless to carry the search any farther; also if very wet you need not expect much; but if comparatively dry and friable there are more hopes of success.

As a general rule the north and east sides of the trunk are drier than those which are exposed to the heavy rains brought by the south and south-west winds, and are consequently more favoured by larvæ that are seeking a resting place for the winter.

Most larvæ seek shelter in the angles between the roots of the trees on which they fed, but a few species seem to prefer the edges rather than the corners; and in cases where no such angles are formed at the surface you will do well to examine the earth and turf all round the trees; but it is generally useless to extend the search more than a few inches from the tree.

After having searched every available nook and corner as far as possible without digging, thrust the trowel obliquely into the soil a few inches from the tree, turn over the soil, and then examine the spot from which it was removed. Now give your attention to the sod itself. If loose and friable, break it up gently, keeping a sharp eye for falling pupæ, and also for earthen cocoons that are easily mistaken for little lumps of soil.

If the soil is held together by roots, it must be pulled to pieces, and the fragments shaken over a bare piece of ground where the fall of a pupa or cocoon could be easily seen; and if you have removed a grassy turf, it will be necessary to look between the bases of the blades as well as among the roots.

In this way you may search round tree after tree, wherever the soil is of such a character as to allow of the admittance and shelter of larvæ. But the variability of your success will be quite beyond your comprehension. Sometimes you will sight a grand old oak with the most favourable anticipations, and consider yourself quite certain of a good find when you discover, on a nearer approach, the liberal coating of moss that clothes its trunk and the dry sandy soil at its foot; and yet the most careful search ends in nothing but disappointment. At other times you try your luck at tree after tree without ever seeing a single pupa or even a cast-off case, and then, when just on the point of despairing, you search round another that is apparently much less promising, and, to your great surprise and delight, a dozen or two are turned out in a few minutes. Such an occurrence as this is not at all uncommon, and cannot be satisfactorily explained, but we must take things as they come and make the best of them, remembering that pupa searching is one of the best of all entomological operations wherewith to test one's perseverance and patience.

It may be mentioned, in conclusion, that the pupæ of *Lepidoptera* are never to be found far below the surface of the soil. Generally they exist, if buried at all, only an inch or two down, and very rarely at a greater depth than four inches.

In our next chapter we shall learn how to rear the perfect insects from the earlier stages we have been considering.

CHAPTER VIII

REARING LEPIDOPTERA

Management of Ova

In the management of insects in all stages the strictest attention must always be paid to one general rule on which the success of the work almost entirely depends; and that is—keep every specimen as far as possible under the same conditions as those in which you find it in nature.

Applying this principle to ova, we store them in airy and light places, protected from the direct rays of the sun, and avoid handling and rough treatment of any kind. It is also advisable in most cases to maintain a slight amount of dampness corresponding with that of the open air at the particular season of the year.

They do not require much space, and it is certainly desirable not to give much, otherwise the newly hatched larvæ, when their time arrives, will actively wander all round their premises in search of food, and give you no end of trouble in gathering them up.

Chip boxes are, as a rule, very good and very convenient receptacles for ova. After placing the eggs in these, cover them over with very fine muslin, held in place by elastic bands, and label each as far as you can with the name of the species contained, and other particulars worth remembering. The boxes may then be put in front of a window facing north or in any situation within or out of doors where rain and sun cannot reach them. A greenhouse is an admirable place in which to keep them, the natural dampness of the atmosphere being apparently a considerable assistance to the tiny larvæ just as they are striving to escape from their shell.

Whatever place is selected, it is absolutely necessary that the ova be carefully watched so that each brood may be supplied with the required food plant within a few hours of quitting the shells.

When ova are kept in a warm room, very great inconvenience and even loss is sometimes caused by the appearance of larvæ before the necessary food plant shows its buds. Yet, on the other hand, it is sometimes a great gain to the entomologist to get certain broods off early in the season, providing the food is at hand; for in this way he can not only get some of his work over during a slack season, but also, if he desires it, secure an additional brood; that is, one brood more than the usual number. Thus, supposing a certain species he is rearing is naturally double-brooded, he can, by judicious management, secure three successive broods before the food plant casts its last leaves.

This hastening of the natural events of insect life is known as *forcing*, and merely consists in subjecting the species concerned to a reasonable amount of artificial heat, such as that of a room in which a fire is always kept, or of a hothouse.

It is interesting at all times to note the dates on which eggs are laid or collected, and the times at which the young larvæ appear. In addition to this all changes that take place in the colours or forms of eggs should be carefully observed; for such changes will assist you in distinguishing between fertile and sterile ova, and also enable you to judge approximately as to the date of the appearance of future broods.

Rearing Larvæ

The main point in connection with the rearing of larvæ is certainly the selection and construction of the cages or their substitutes. For newly hatched and all very small caterpillars a small bottle with a wide mouth makes a very fair abode. Put a layer of sand or sifted soil in the bottom, fix in this a small twig of the food plant or lay a few leaves on the top, and then, after the larvæ have been introduced, cover the top with a piece of muslin, held in place by an elastic band.

The great drawback with this arrangement is the lack of any provision for keeping the food moist and fresh, thus rendering a change necessary at very frequent intervals; but this may be obviated by using damp sand as a foundation for the little twig of food plant. With this improvement, if you cover the top of the bottle with a piece of glass, a saucer, or any impermeable substance, you may keep the twig fresh for several days, generally until the disappearance of the last leaf calls for a fresh supply; but it is very doubtful whether the damp atmosphere resulting from this inclosure is not injurious to the larvæ. It certainly does not seem to have much influence on some, but the unhealthy conditions that result must be detrimental to the inmates. It must also be remembered that many species require a *dry* soil in which to burrow when about to change.

When the time comes for the change of food, great care must be taken not to injure young and small larvæ. In many cases they need never be touched, for if a fresh twig be placed beside the stale one, they will readily find their way to it; and to facilitate this, and also to afford a convenient foothold to those larvæ that accidentally fall from the twig, the layer of sand at the bottom of the bottle should be covered with moss or cocoa-nut fibre.

If you find it necessary to move the larvæ yourself from the stale food, never touch them with your fingers, but lift them gently by means of a small camel-hair brush. Larger larvæ need never be moved at all. They will always search out fresh food for themselves, and the stale may be removed after they have quitted it.

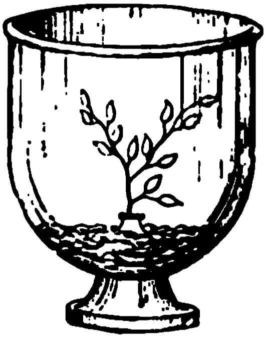

FIG. 57. A LARVA GLASS.

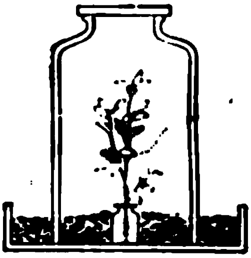

FIG. 58.—A LARVA GLASS.

For rearing larger species ordinary bottles are hardly satisfactory, and we must either use large jars or construct cages of some kind.

An ordinary bell jar such as is used for covering ferns or for aquaria makes a very useful 'larva glass.' Place a small bottle of water at the bottom, and then introduce sufficient dry clean sand or sifted soil to reach up to its neck. On the top of this place a layer of moss or cocoa-nut fibre. Next introduce the food plant, fixing it firmly in the bottle of water, and plugging up the space between the stem and the rim with cotton wool. This precaution is to prevent the larvæ from falling into the water as they attempt to pass up or down the stem, and the wool also helps to keep the twig in a vertical position. The glass is now ready for the caterpillars, but it is advisable to keep a covering of muslin or gauze over the top in all cases even though the larvæ contained are unable to creep up the surface of glass, for the great enemies of caterpillars —the ichneumon flies –are always on the alert, and will often take advantage of an open window to 'sting' the larva rearer's pets.

Another form of larva glass can easily be made out of a large glass jar if you know how to cut off the bottom, or of a chemist's bell jar which is open both at top and bottom. In this case the bottle of water and the soil are arranged as before in a pan of unglazed earthenware, and then covered over with the glass. This is shown in fig. 58, and is an exceedingly convenient larva house, since the lifting of the glass enables you to get at the insects without any trouble.

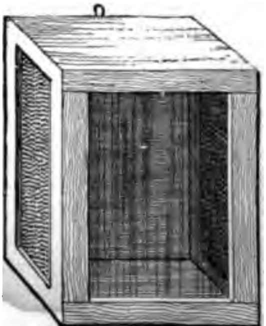
Fig. 59.—A Larva Cage.

Wood larva cages are very commonly used for the larger species after they have attained a fair size and require more food than can be stocked in bottles and glasses. These cages have glass fronts, either sliding or in the form of a hinged door, and sides of perforated zinc. They are kept in stock by all dealers in entomologists' requisites, but equally useful ones are easily constructed. If you select a box of suitable size at the grocer's, cut out large pieces from the lid and sides with a fret saw, and fix in the glass and zinc, you will have a cage that will answer all purposes.

The internal arrangements consist of a shallow tray filled with soil, in which stands the bottle of water for the food, and a layer of moss sufficiently high to cover the bottle completely.

A series of such boxes standing on end on a shelf, or hanging on a wall, will form a very satisfactory nursery for your pets, and will occupy but little space.

We have already observed that some larvæ burrow into soil when about to change, while others creep to a sheltered corner, or suspend themselves from the food plant itself. It will be seen that the larva cage just described supplies all these demands, and care must be taken not to disturb the occupants while they are undergoing their metamorphoses. Those that suspend themselves on the food plant should be allowed to remain where they have fixed themselves, and when it is necessary to remove the stale food in order to give a fresh supply to the later larvæ, let it be fixed in an airy place where it can be watched till the perfect insects emerge. Those which suspend themselves on the sides or top of the cage, or spin cocoons in the corners, should never be disturbed unless you are greatly in want of the same cage for the accommodation of another brood; and even then it is possible that their presence will not in any way interfere with the new species. But if their removal becomes a necessity, let it be carried out as carefully as possible, and not until the change to the pupal stage is known to be complete.

The species that burrow into the soil or bury themselves in the moss need never be disturbed till the rearing season is quite over, and then they may be transferred to a box specially kept for the accommodation of pupæ.

There is yet another method of rearing larvæ to which we must refer—a method known as 'sleeving'—particularly useful when you happen to have the required food plants in your own garden. The ova or larvæ are placed on the plant, the whole or part of which is then covered with a bag or 'sleeve' of gauze. The larvæ thus imprisoned have the full benefit of fresh air and light, and are also free from the attacks of ichneumon flies. They have a fair amount of liberty, and yet cannot get beyond your reach; also abundance of fresh food without further trouble on the part of the rearer.

But even this arrangement is not perfection. It will not suit the night feeders that like to hide beneath the soil during the day, and it interferes somewhat with the burrowing tendencies of those which pupate underground. These little difficulties, however, can be overcome by placing the food plants in large pots or tubs of soil, and tying the mouth of the 'sleeve' round the outside of this utensil. If this cannot be done, those insects that pupate underground must be removed from the plant when their restless disposition shows that the changing time has arrived, and then be transferred to a box of soil where they can find the seclusion they seek.

The larvæ that hibernate throughout the winter are rather more troublesome, especially those which are inclined to take a ramble on certain mild days in search of food when none is at hand. Still there is no reason why even a beginner should not attempt the rearing of these. They will require food in the autumn until the cold weather sets in, and again early in spring as soon as the new leaves appear; but this is not of much consequence to those who reside in districts where the required food plants abound.

Wood feeders also require some special treatment and precautions, and the successful rearing of some is a matter of no little difficulty. A wooden cage is, of course, quite out of the question with these, unless you wish to test the power of their jaws. They must be kept in large pots or jars, covered over with wire gauze or perforated zinc, and supplied with fresh stems or logs of wood, or with moist sawdust fresh from their favourite tree. A few of them —the 'Goat' (page 224), for example—will eat dead and rotting wood, and may be fed on old palings and other waste providing the right kind is selected.

The troubles and disappointments of larva rearers are numerous and varied, and commence with the earliest moments of the young insects. Even the hatching period sometimes proves a trial, for it occasionally happens that the young larva has not sufficient strength to bite its way through the shell that surrounds it, and dies with nothing but the surface of its head exposed to view. This may be the result of keeping the ova in too dry a spot, the shell having become too hard and horny for the little creature's jaws.

Then the moulting seasons are always periods of trial to the larvæ, and often of loss to the rearer. Some of the hardier species may pass through all their moults without appearing to suffer anything more than a slight inconvenience at each, but in other cases the greater part of a brood may fall victims to these ailments of the growing stage.

Apart from these sources of loss, however, larvæ are subject to numerous diseases, infectious and otherwise, about which we know but little. A fever may rage in one of our cages; a fungoid growth may establish itself on the bodies of our pets, or we may see them cut down, one by one, through a fatal attack of diarrhœa.

In many such cases we are at a loss as to what to do. Blue pills and black draughts are not to be prescribed, and the modern practices of surgery and inoculation have not yet been applied to insect patients with very great success; but we must do our best to adopt hygienic principles, paying the greatest attention to proper means of ventilation and to a regular and wholesome dieting. In the case of diarrhœa—a very common insect malady—the best we can do is to avoid the young and juicy leaves of the food plant, and substitute the older and drier foliage.

Ichneumon flies have already been mentioned as great enemies of larvæ. These flies either deposit their eggs on the skins of caterpillars, or thrust their sharp *ovipositors* into the creature's flesh and lay their eggs beneath the skin. When the young ichneumons are hatched, they immediately begin to feed on the fatty matter that is usually stored in comparative abundance under the skin of the caterpillar, and thus they grow at the expense of their host, within whose body they lie completely hidden from view.

The poor caterpillar, though being eaten alive, often shows no external signs of the mischief wrought within, and, even though its substance is really decreased by the hungry internal parasites, yet the rapid growth of these robbers maintains the general plumpness of a healthy larva. But the ichneumons, having at last devoured the store of fat, and avoided the vital organs of the caterpillar, as if with a view to preserve their living home to the latest moment, now commence to attack the latter, speedily reducing the vitality of their host to the lowest ebb, and finally causing its death.

This untimely end may come before the caterpillar is full grown, or the insect may change to the pupa before the ichneumons have done their worst, but it rarely occurs that the unfortunate creature has sufficient strength to carry it on to the final stage.

A large number of the collected larvæ will have been 'stung,' much to the disgust and disappointment of the rearer; and hence the advantage of rearing your specimens from ova wherever possible, providing you keep them so well under cover that the ichneumons cannot visit your broods.

The Management of Pupæ

[illegible] disappointment [illegible] connected with the rearing of *Lepidoptera* [illegible] when all have passed successfully into the pupal [illegible], and the number of perfect insects obtained will often fall far short of the number of pupæ in your boxes; but we must now see what can be done to minimise the death rate of the captives.

One or more suitable boxes must be prepared for the reception of the pupæ, and the following suggestion will answer all purposes:

Get a wooden box, quite rough and unplaned inside, large enough to accommodate your pupæ with ease, and not less than eight inches deep. Make several holes in the bottom, or else knock the bottom completely out, and nail in its place a sheet of perforated zinc. Also make a lid consisting of gauze attached to a light wood frame.

Place a layer of clean gravel, about an inch deep, in the bottom, and over this a few inches of sifted soil or cocoa-nut fibre.

Now take all the pupæ that are 'earthed' in your cages, and arrange them on the prepared bed; also add to them the pupæ you may have dug out during your various excursions. Cover all with a layer of the material selected for the bed, and then add a layer of moss.

Next come the pupæ that are suspended by silky fibres, or are inclosed in cocoons. These should be fixed with pins around the sides of the box, running the pins either through the tuft of silk at the 'tail,' or the outer layer of the cocoon, or through the portion of the dried food plant to which they are attached.

Here your pupæ will remain till they emerge, and the box may be kept in any airy place where it is not likely to be forgotten, for it is essential that the perfect insects should be removed as soon as possible after quitting their cases. It does not matter much whether the pupæ be kept in or out of doors, providing they are sheltered from rain and very severe frosts; but of course, if the former, the imagines will emerge a little earlier, even if the room in which your specimens are stored has no fire.

Even when protected in boxes such as that described the pupæ are subject to enemies and dangers. The soil and moss employed may contain slugs, mites, or other creatures which prey on insects, and the amount of moisture present in these materials and in the atmosphere may prove too little for some species or too much for others.

The remedy for the former evil is a simple one. Bake the soil or fibre well before fitting up the box, and boil and afterwards dry the moss. You may then be sure that all life previously contained is quite destroyed.

But the degree of humidity is a point not so easily settled, and so variable are the experiences and opinions of different entomologists that it is difficult to advise a beginner on the subject. The fact that some strongly advise a perennial dampness, while others recommend no attempt at the application of water, would seem to show that there are probably important points to be urged on both sides.

Nothing can be better than a very careful observation of pupæ in their natural conditions. When engaged in pupa digging you will observe that the larger number are to be found on the east and north sides of trees where the soil is protected from the heaviest rains; on the other hand a good many are certainly found in very moist and sometimes even in wet situations.

Particular notice should be taken of such experiences, making every allowance for the exceptions that prove the rule, and then let the natural conditions be maintained in your nurseries at home. To carry this out two pupa boxes should be kept, one for those species that seem to require dry situations, and the other for the species that apparently do best with moist surroundings.

But when it is desired to maintain the pupæ in a moist condition, great care must be taken not to allow any accumulation of stagnant water. The box we have described, with its bottom of perforated zinc, is well adapted for this purpose. Let it stand on a couple of strips of wood, so that any excess of moisture may readily drain through. The perforated bottom will also allow of a free circulation of air, thus securing the ventilation that is desirable in all boxes, whether wet or dry.

If you have any insects that have pupated within moist stems, they should be kept in a moist condition till they emerge. The simplest way of doing this is to support the stems in a layer of wetted but well-drained silver sand.

Forcing may be resorted to when it is required to obtain the imagines for early setting in order to get them in the cabinet before the busy season begins. The method is simple. Place the pupa box [illegible] in a room where a fire is kept constantly. By this means you may get all your specimens out within a few weeks, even when you start the forcing [illegible] winter. If, however, you require the [illegible] that the [illegible] pupæ [illegible].

When you are expecting the appearance of perfect insects, the [illegible] pupa boxes should be examined every day. A morning visit to your pupæ (for most insects emerge in the morning) may reward you with the sight of a newly emerged imago, clinging to the rough surface of the box, thus affording you an opportunity of observing the wonderful expansion of the wings. But the greeting is not always of such a pleasant character, for your disappointed eyes will sometimes be cast on a host of horrid ichneumons that have just quitted a shell from which you were expecting a prize of some specially valued species.

CHAPTER IX

SETTING AND PRESERVING

Setting and Preserving Butterflies and Moths

Up to the present we have been dealing only with living forms—learning how to catch and rear the Lepidoptera that fall to our lot; but now we have to become acquainted with the methods of preparing our dead specimens in such a way that they may form a useful collection for future study and reference. Our first attention shall be given to the apparatus necessary for this work.

The most important requirement is the setting boards, of which several are necessary, the sizes varying according to the dimensions of the different insects to be 'set.' The *lengths* of all the boards should be the same, not only for the convenience of packing when not in use, but also in order that they may, if required, be arranged neatly in the 'drying house' to be presently described. The widths only will vary, and in this respect the boards must be adapted to the measurements of the insects from tip to tip when the wings are fully expanded. Thus, a set of a dozen boards, ten or twelve inches long, and from one to five inches wide, will do for a good start. Of course you may commence with a smaller number than twelve, but if you really mean to do the thing well, you will eventually require a good stock of boards.

Here, again, it may be mentioned that all the necessary requisites may be purchased ready for use, a set of boards and a drying house complete costing from ten to twenty shillings according to size and quality; but as the reader, like myself, may prefer to construct his own, I will supply him with hints and suggestions sufficient for the work.

Each board is constructed in this way. Cut or get planed up a piece of wood of the required length and width, and about one-eighth of an inch thick. Glue on the top of this a layer of cork about half an inch in thickness, leaving the whole under a moderate pressure until the glue is quite hard. The sheets of cork for this purpose may be bought at any naturalist's stores; but slices cut from good large bottle corks may be made to answer equally well if you don't mind the extra time expended in cutting and fixing.

When the glue has well set, trim off the edges of the cork flush with the sides of the wood, and then cut out a groove down the whole length of the cork, of course in the middle, and of such a size that it will just contain the bodies of the insects for which it is intended.

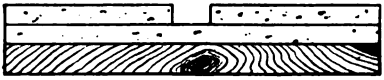

FIG. 60.—SECTION OF A SETTING BOARD.

The satisfactory cutting of this groove is not a very easy matter, but if its position is first carefully marked, a long rat-tail file may be made to plough it out neatly and regularly. As an alternative the following plan is good. First cover the wood with a layer of cork about a *quarter* of an inch thick, and then glue on the top of this *two* narrower strips, about as thick as the bodies of the insects for which the board is intended, leaving a space of the required size between them, as shown in fig. 60. In this way you get a groove of square section, that is in some respects preferable to the round one cut out by means of the rat-tail file.

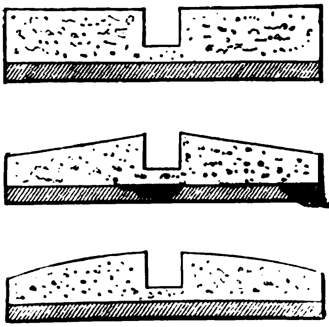

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FIG. 61.—SECTIONS OF SETTING BOARDS.

Now comes a question about which there is a difference in the tastes or fancies of entomologists. Shall the boards be perfectly flat on the top, or shall the sides slope from the groove, or shall the surface be rounded? A glance at the three sections of setting boards will show clearly what is meant. The rounded board is most commonly used, and the graceful curve thus given to a butterfly or moth set on such is certainly attractive; but it is not natural. The wings of these insects are rigid, and are never seen bent into such curves in a living specimen. For this reason I much prefer a perfectly plane surface on each side of the groove.

Then, as to whether there shall be a slope or not, this is a matter of less importance. A very decided sloping of the wings is certainly not so convenient for future examination; nor does it, to my mind, look nearly so well as both sides in the same plane, or at a very gentle inclination. But perhaps this subject had better be left to the taste of the reader, remembering, however, that, whatever plan be adopted, all the boards should be alike in this respect, so that there may be a degree of uniformity in the cabinet.

The surface of the cork must, in all cases, be nicely smoothed down with glass paper, and then covered with thin white paper, fixed to its surface with ordinary paste.

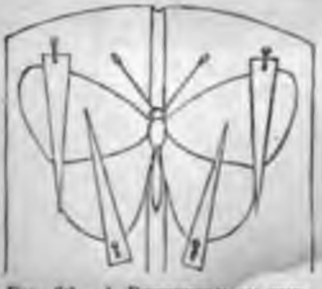


Fig. 62.—A Butterfly on the Setting Board.

When insects are on the boards, they should be placed in an airy spot, as free as possible from dust, while they are drying. Hence the advisability of some form of 'drying house.' This is simply a box, standing on end, and provided with a hinged door consisting of a sheet of perforated zinc in a wooden frame. The boards may slide in this on little slips of wood nailed or glued on to the sides, or the wooden bases of the boards may project beyond the cork at the ends, and slide into grooves in the side of the house.

Beyond these requirements nothing is wanted save a good stock of pins, thin card or ordinary writing paper, and a 'setting needle.' The last-named item is simply a needle mounted in a handle, and a good one may be made by thrusting the head of a darning needle into a piece of twig. The pins used for setting—that is, for fixing the pieces of paper or card to keep the parts in position—may be of the ordinary kind; but entomological pins are far preferable, even for this purpose; for, being much thinner, they do not damage and disfigure the setting boards so much.

Now as to the setting. First see that the pin with which you are to fix your dead insect passes centrally through the thorax. Then fix it firmly on the setting board, its body lying neatly in the groove of the cork. Cut out some little pointed strips of card or paper, and, after bringing the wings into position with the setting needle, fix each one by a pinned strip. In spreading out the wings, care must be taken not to pierce them at all, but simply to push them into their place by pressing the needle at their bases, or by putting the needle beneath and *lifting* them out.

Instead of pointed pieces of card, uniform strips of paper may be used, as shown in fig. 63, each strip passing over both wings.

After the four wings have been properly arranged, a few extra pins may be used to keep other parts in position. Thus, the antennæ may be placed at equal angles, the proboscis may be extended, and a couple of pins may be used to support the abdomen if it is inclined to bend downward.

As before mentioned, insects should be set soon after they are dead, while the parts are still soft and supple. But where this cannot be done, and the specimens have become stiff, brittle, and rigid, they must be 'relaxed' before any attempt is made at setting them out.

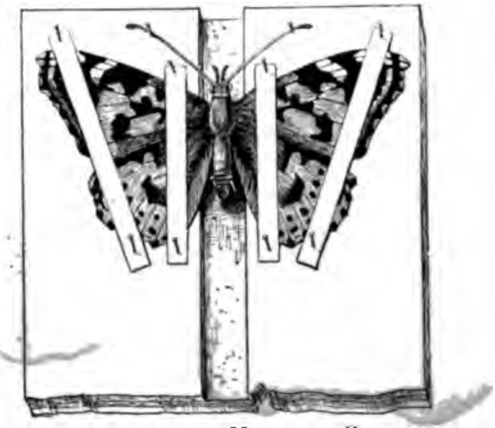


FIG. 63.—ANOTHER METHOD OF SETTING BUTTERFLIES AND MOTHS.

This process of relaxing consists in placing the specimens in a very moist atmosphere for a few days. There are several simple ways of doing this, many of which will readily suggest themselves to the reader. Your collecting box, if a zinc one, may also be used as a relaxer. Pin your stiff insects in it, after well moistening the cork, and simply shut them up for a day or two. Any metal box will serve the same purpose providing you put into it a piece of sheet cork on which to fix the insects, and this cork may rest on a bed of moist sand.

Another plan is to float the pinned specimens on corks in a shallow vessel of water, and cover them over with a bell glass.

Insects that are being relaxed should be examined from time to time, and the degree of flexibility acquired tested by a gentle pressure of the setting needle or by blowing on them. If not sufficiently supple, give another day in the damp cell, but never allow them to be forgotten till they are covered with mildew.

The time occupied in thoroughly drying butterflies and moths will vary considerably according to their sizes and the condition of the atmosphere. In hot and dry summer weather four or five days will prove quite sufficient for the *very* small and thin-bodied species. From one to two weeks, however, may be looked upon as the average period; but the large and thick-bodied moths may require more than this.

Perhaps the best test of their condition is the gentle pressing of the setting needle against the abdomen—the last part of the body to become dry and stiff. If the abdomen seems quite firm and rigid, you are pretty safe in removing the specimen from the board; but if it bends at all under a slight pressure of the needle let it remain for a day or two longer.

If your cabinet is quite ready for the reception of new-comers, the insects may be put in their proper places immediately after their removal from the setting boards; but if not, they may be pinned temporarily in a 'store box' till the time comes when you have proper accommodation provided. The full consideration of these matters will be dealt with in another chapter.

It is possible that the setting of some of your specimens will not exactly please you. If such is the case, put them in a relaxing box for a day or two, and then reset them more to your fancy.

We have now to deal with a matter that applies more particularly to moths, especially the very large and thick-bodied species. The abdomens of these become more or less contracted and shrivelled on drying, sometimes to such an extent as to look most unsightly.

There is a remedy for this, and the time and patience required in working it out will be well repaid by the superior results obtained.

While the abdomen is still in a soft condition, make a slit throughout its length with a very sharp knife or a sharp pointed pair of scissors. This slit should be made down the centre of the under surface, if the insect is to be placed in the cabinet with the under side exposed, down the middle line of the back. Then remove all the contents of the abdomen, scraping them out with a piece of hooked wire, or removing them with a fine pair of forceps, and leaving the skin as clean as possible both within and without.

Now introduce a packing of cotton wool, just sufficient in quantity to maintain the natural form of the body as the specimen dries.

There is another good method of stuffing moths that possesses a decided advantage over the one just described, since it leaves the specimen in such a perfect condition that it shows no appearance of having been stuffed when viewed from either side. This consists in snipping off the abdomen at the waist, clearing out the contents with a hooked wire, lightly stuffing it with cotton wool pushed in at the waist, and then setting it aside to dry, while the other part of the insect is undergoing the same process on the setting board. When both parts of the moth are thoroughly dry, the stuffed abdomen is easily fixed in its place with a little coaguline; and this, if neatly done, will not show the slightest sign of the treatment to which the insect has been submitted.

Even after your insects are finally housed in the cabinet, they are subject to two other dangers, both of which are more destructive to moths than to butterflies. One is technically known as 'grease,' and the other is the invasion of certain museum pests that feed on the specimens, causing them to fall to pieces.

Examine the moths that have been for a time in the cabinet, and some are sure to exhibit an oily or greasy appearance, the hairs of the abdomen, and perhaps also of the thorax, being clogged together just as if the specimen had been dipped in oil, the same miserable condition, perhaps being shared also by parts of the wings.

This is due to the gradual oozing out of the fatty matter that is always present to a greater or less extent in the bodies of the insects, and which must necessarily show itself more sparingly in specimens that have been carefully stuffed.

The old saying, 'Prevention is better than cure,' applies well in the present case; but as there are times when a knowledge of the 'cure' is the only means of saving a valuable specimen from destruction, we will study both.

To deal with the two in the order of the well-worn proverb, we will consider the prevention first. Always carefully clean out and stuff the abdomens of large-bodied insects; and as a rule, treat them with some substance that will either absorb or dissolve out all oily matter. I think the best plan is to remove the abdomen, clean it out if its size permits of such an operation, and then, after labelling it to prevent its future application to the wrong body, either let it remain in a bottle of magnesia for several weeks, or soak it in benzole or ether for a few hours or longer.

If magnesia has been employed as an absorbent, you have simply to blow or lightly brush off the loose powder that clings to the body, and then fix it in its place with coaguline. A body dipped in ether or benzole will look as if completely spoilt at first, for the furry coat that clothes it will lie matted and almost entirely robbed of its beautiful colours, reminding one forcibly of the proverbial 'drowned rat.' But take no notice of this change. Let the body have at least a few hours in the liquid, extending the time to a day or two in the case of very large ones and those which experience has proved to be particularly liable to 'grease;' and, immediately on withdrawing it, fix it with a pin in a good strong draught, such as you may obtain by opening a window about an inch, or, if a breezy day, in the open air.

These liquids are so volatile (and for that reason should never be left exposed in an open vessel) that they rapidly evaporate, leaving the dry hair to be loosened by the breeze, thus bringing back the natural appearance almost perfectly.

It is probable that many of the smaller insects that were not considered to require the stuffing or grease-removing operations will sooner or later exhibit a greasy tendency in the cabinet. At first the abdomen is affected, and the oily matter then gradually creeps over the rest of the body, finally spreading over the wings, and giving the insect a most deplorable aspect. But these are not irreparably lost, and the following cure will often bring them back to their former beauty.

If the abdomen only shows signs of grease, cut it off and soak it in one of the above-named liquids for a day or so, replacing it as above after the drying operation. If, however, the oily matter has spread to the thorax and the bases of the wings, the whole specimen must be soaked, using a basin or jar of suitable size, covered with a plate of glass. A good draught during the drying operation will do much to prevent the hair from sticking in matted tufts close against the surface of the body and wings, and a gentle brushing with a very soft camel hair brush will loosen and reset the fur.

The other danger to which we have referred is the invasion of certain mites and other museum pests that pay periodical visits to our cabinet drawers and store boxes, often committing such havoc as to severely try the patience of an interested naturalist.

The way to prevent such intrusions is to make the atmosphere of the compartments so obnoxious (to them) that they dare not enter; and, further, to so spice up your specimens that they are no longer safely edible to the invaders.

The first object can be attained by always keeping camphor or naphthaline (albo-carbon) in each division. A lump of either substance may be secured by pins or a little perforated cell in the corner of each drawer or box, or the bottom of each may be dusted with finely powdered naphthaline; but as both these solids are volatile, care must be taken to renew the supply as occasion requires.

Then, with regard to the second precaution, perhaps nothing is more effectual than corrosive sublimate. A little of this may be dissolved in a small bottle of alcohol (spirits of wine), labelled with the name and the word POISON, and kept ready for use. All the skins of stuffed specimens should be painted with this solution, and the stuffing itself may be moistened with it before insertion.

There is yet another circumstance that renders a watchful care of your cabinet specimens necessary, if you happen to possess many that were captured 'at sugar.' Some of these will have so gorged themselves with syrup that they are literally full of it, and this will sometimes find its way to the outside, often dropping on the surface beneath. In such cases the sugar should be removed as completely as possible, and the bodies stuffed, before they are quite dry; but if the specimens have been in the cabinet so long that they are stiff and hard, the under sides of the abdomens may be completely cut out with a very sharp knife and thrown away, and then the sugar cleaned out from the upper shell as neatly as possible.

CHAPTER X

PRESERVING OVA, LARVÆ AND PUPÆ

MANY young entomologists give their attention almost solely to the perfect forms of insects, often collecting and studying a very large number of species without regard to their earlier stages and metamorphoses. This is decidedly a very great mistake. Although the lifeless form pinned in a cabinet may be a most beautiful object in itself, yet a study of this alone is uninteresting compared with that of the wonderful changes it has undergone since the time it was a very young larva.

The different stages of the insects should be known as far as possible, and these, as well as the perfect forms, should be included in the collection for future study and reference. A good cabinet, according to my own opinion, is one that possesses, among other good features, a number of complete sets illustrative of the life history of at least the more typical forms; and as it is not a difficult matter to preserve the earlier stages, there is really no excuse for their omission from the collection.

The empty shells of ova are in themselves sometimes interesting objects, especially when they illustrate some peculiar instinct on the part of the parent. Sterile eggs, also, often fall into the hands of breeders and rearers, and these, though in other respects unprofitable, are useful in the cabinet.

If fertile eggs are to be prepared for a collection, they must be killed. This is easily done by thrusting into each one the point of a very fine needle, or by immersing them for a moment in boiling water, or by shutting them up in a bottle with camphor. In drying they often contract more or less, and frequently change their colour; still these are useful, providing notes have been taken of the characters thus lost. The larger eggs are capable of special treatment where the owner has the necessary time and patience, and where the highest results are desired. By means of a surgeon's injector of small size the contents of the eggs can be removed; and then, by the same instrument, a warm solution of gelatine, coloured in such a way as to restore the natural tint, may be forced into the empty shell. As the gelatine cools and hardens, it prevents any shrinking of the shell, and thus both form and colour are well preserved.

For the preservation of larvæ you will require one or two simple appliances.

The first of these is a suitable glass blowpipe, one form of which is here illustrated. It consists of a glass tube, one end of which has been drawn out very fine; a piece of watch spring tied to it in such a manner that it will hold the skin of a larva at the small end, and a piece of india-rubber tubing at the other end, pressed by means of a brass spring clip.

A little drying oven is also very useful, but not absolutely necessary. If you decide to have one, any square box of sheet iron (not soldered tinned iron) may be readily converted into one. It must be provided with a hinged door in the front with a ventilator at the bottom, a hole for the escape of hot air at the top, and a tripod wire stand inside on which to rest the specimens while drying. The whole should be supported on a wire stand, so that heat may be applied below.

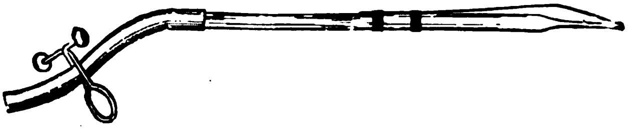


Fig. 64.—A Blowpipe for Larvæ.

Each larva to be preserved should be dealt with in this way. First kill it by means of any one of the killing bottles or boxes already described, or by immersion in spirit of wine. When quite dead, enlarge the anal orifice by thrusting a needle into it, and then lay it on a piece of blotting paper with its head toward you. Now take a round ruler, previously covered with blotting paper, and roll the larva gently from head to tail till all the contents of the skin have been expelled. Next fix the skin on the fine end of the blowpipe, by thrusting the point of the latter into the opening, and allowing the spring to press gently on its edge. Gently blow into the skin till it is inflated just to a *little below* natural size, then either hold it near a fire or rest it in the drying oven till it is quite dry and rigid.

If you have done your work neatly, the skin and blowpipe will both be quite air-tight when the clip is closed; and the air, finding no outlet, will still further inflate the skin when it expands on exposure to heat. This is the reason why you are directed to blow it out to something short of the natural dimensions. If you find that this expansion causes the skin to stretch beyond its normal size, a little of the air must be allowed to escape while it is yet soft and flexible.

The front of the larva is generally the last portion to become dry, and when this is quite rigid the skin may be removed from the blowpipe. This is a matter that requires the greatest care; for the skin is so very thin and brittle that a little rough handling will break it to pieces. As a rule it may be easily pushed off the pipe by a slight pressure behind, or a gentle twisting motion will loosen its hold; but this latter method can hardly be applied to hairy larvæ without breaking off the hairs, now rendered very brittle by the heat.

If you find the slightest difficulty in detaching the skin of a valuable specimen, it is far better to damage the blowpipe than to risk spoiling the skin. Supposing your blowpipe is a glass one, you can easily break off the end of it after making a cut with a very small triangular file, and the portion thus removed may be left
hed to the skin. Then, after softening the glass blowpipe in a
or the flame of a spirit lamp, it can be drawn out thin
future work. Those who can manipulate glass tubing in this way will find it far better to lay in a stock of suitable material, drawing it out when required, than to purchase blowpipes ready made at the naturalist's shop.

Very fine hollow stems, such as those of the bamboo cane, may be used instead of glass; and these possess the advantage of being easily cut with a sharp knife when there is any difficulty in removing the skin. Again, whether glass or fine stems are used, a little grease of any kind placed previously on the end will allow the dried skin to be slid off with less difficulty.

Preserved larvæ should preferably be mounted on small twigs or artificial imitations of the leaves of the proper food plants. A little coaguline applied to the claspers will fix them very firmly on these twigs or leaves, which are then secured in the cabinet by means of one or two small pins.

It is much to be regretted that the natural colours of many caterpillars cannot be preserved in the blown skins. Some are rendered much lighter in colour on account of the withdrawal of the contents, while others turn dark during the drying. In the smooth-skinned species the natural tints may be restored by painting or by staining with suitable aniline dyes, but these artificial imitations of the natural colours are always far less beautiful than the hues of the living larvæ.

Very few words need be said on the preservation of pupæ. Many of them do not alter much in form and colour, and therefore they require no special preparation.

If a pupa has to be killed for the purpose of adding to the value of the collection, simply plunge it into boiling water, and it is ready to be fixed in the cabinet as soon as it is quite dry.

The empty pupa cases, too, from which the perfect insects have emerged, are often worth preserving, especially if the damage done by the imago on forcing its way out is repaired with the aid of a little coaguline.

Let all larvæ and pupæ be preserved in their characteristic attitudes and positions as far as possible, so that each one tells some interesting feature of the life history of the living being it represents. Further, enrich your collection by numerous specimens of the various kinds of cocoons constructed by the larvæ, pinning each one beside its proper species; and never refuse a place to any object that relates something of the life history of the creatures you are studying.

CHAPTER XI

THE CABINET ARRANGEMENT OF SPECIMENS

The selection of a cabinet or other storehouse for the rapidly increasing specimens of insect forms is often a matter of no small difficulty to a youthful entomologist. Indeed, there are very many points of considerable importance to be considered before any final decision is made. Freedom from dust, the exclusion of pests, the convenience of the collector, the depth of his pocket, and the general appearance of the storehouse must be considered, and it is impossible, therefore, to describe a form that is equally suitable to all.

If it is absolutely necessary that the cabinet (or its substitute) be of a very inexpensive character, and if, at the same time, the collector has not the mechanical skill necessary for its construction, then perhaps the best thing he can do is to procure a number of shallow (about an inch and a half deep) cardboard, glass-topped boxes, such as are to be obtained at drapers' shops. For the sake of uniformity and convenience in packing, have them all of one size. Glue in small slices of cork just where the insects are to be pinned, and see that each box is supplied with either camphor or naphthaline. All the boxes may be packed in a cupboard or in a case made specially to contain them; and a label on the front of each will enable you to select any one when required without disturbing the others.

It may be mentioned here that glass is not necessary, though it is certainly convenient at times, especially when you are exhibiting your specimens to admiring non-entomological friends, who have almost always a most alarming way of bringing the tip of the first finger dangerously near as they are pointing out their favourite colours. 'Isn't *that* one a beauty?' is a common remark, and therewith off snaps a wing of one of your choicest insects. When glass is used, however, see that the specimens are excluded from light, or the colours will soon lose their natural brilliancy.

Anyone who has a set of carpenter's tools and the ability to use them well will be able to construct for himself either a set of store boxes or a cabinet of many drawers in which to keep his natural treasures. In this case a few considerations are necessary before deciding on the form which the storehouse is to take.

A cabinet, if nicely made, forms a very sightly article of furniture; and, if space can be found for it, is the best and most convenient receptacle. One of about twelve to twenty drawers will be quite sufficient for a time; and the few following hints and suggestions may be useful.

The wood used should be well seasoned, and free from resin. The drawers should fit well, and slide without the least danger of shaking. Each one should be lined with sheet cork, about one-eighth of an inch thick, glued to the bottom, nicely levelled with sand paper, and then covered with thin, pure white paper, laid on with thin paste. It is also advisable to cover each with glass, inclosed in a light wood frame that fits so closely as to prevent the intrusion of mites.

The drawers may be arranged in a single vertical tier if the cabinet is to stand on the floor, or in two tiers if it is to be shorter for placing on the top of another piece of furniture; and glass doors, fastened by a lock and key, may be made to cover the front if such are desired as a matter of fancy, or as a precaution against the meddlesome habits of juvenile fingers.

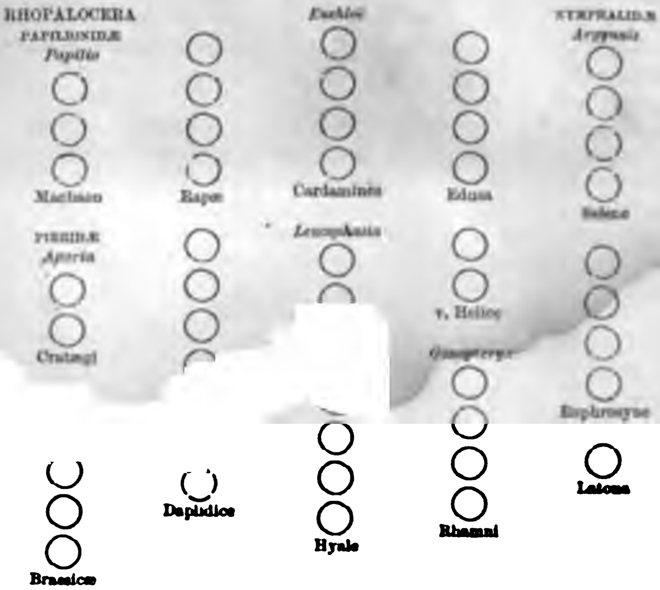
Store boxes are sometimes chosen in preference to cabinets because they are more portable, and because they can be arranged on shelves—an important consideration when floor space is not available.

These boxes should be cork-lined and glazed like the cabinet drawers; and if they are made in two equal portions, lined with cork on both sides, and closing up like a book, they may be arranged on shelves like books, in which position they will collect but little dust.

Both store boxes and cabinets are always kept in stock by the dealers, the former ranging from a few shillings each, and the latter from fifteen shillings to a guinea per drawer. Knowing this, you can decide for yourself between the two alternatives—making and purchasing.

We have now to consider the manner in which our specimens should be arranged and labelled.

The table forming Appendix I contains the names *of all* the British butterflies and larger moths, and shows their division into *Sections*, *Tribes*, *Families*, and *Genera*. This table is the result of most careful study on the part of leading entomologists, and shows how, in their opinion, the insects can best be arranged to show their relation to one another; and you cannot do better than adopt the same order in your collection.



Complete label lists can be purchased, printed on one side of the paper only. These, when cut up, supply you with neat labels for your specimens.

If you intend to study the British *Lepidoptera* as completely as possible, you may as well start at once with a sufficiently extensive cabinet, and arrange all the labels of your list before you introduce the insects. You will thus have a place provided ready for each specimen as you acquire it, and the introduction of species obtained later on will not compel you to be continually moving and rearranging the drawers.

Probably the number of blank spaces will at first suggest an almost hopeless task, but a few years of careful searching and rearing will give you heart to continue your interesting work.

Arrange all the insects in perpendicular rows. Put the names of each section, tribe, family, and genus *at the head* of their respective divisions, and the names of the species below each insect or series of insects. The opposite plan, in which the circles represent the insects themselves, will make this clear.

Three or four specimens of each species are generally sufficient, except where variations in colouring are to be exhibited. Wherever differences exist in the form or markings of the sexes, both should appear; and one specimen of each species should be pinned so as to exhibit the under side.

Finally, each drawer or box should have a neat label *outside* giving the name or names of the divisions of insects that are represented within. This will enable you to find anything you may require without the necessity of opening drawer after drawer or box after box.

PART III

BRITISH BUTTERFLIES

We have now treated in detail of the changes through which butterflies and moths have to pass, and have studied the methods by which we may obtain and preserve the insects in their different stages. I shall now give such a brief description of individual species as will enable the reader to recognise them readily. We will begin with the butterflies.

CHAPTER XII

THE SWALLOW-TAIL AND THE 'WHITES'

Family—PAPILIONIDÆ

The Swallow-tail (*Papilio Machaon*)

Our first family (*Papilionidæ*) contains only one British species—the beautiful Swallow-tail (*Papilio Machaon*), distinguished at once from all other British butterflies by its superior size and the 'tails' projecting from the hind margin of the hind wings.

This beautiful insect is figured on Plate I, where its bold black markings on a yellow ground are so conspicuous as to render a written description superfluous. Attention may be called, however, to the yellow scales that dot the dark bands and blotches, making them look as if they had been powdered; also to the blue clouds that relieve the black bands of the hind wings, and the round reddish orange spot at the anal angle of each of the same wings.

It appears that this butterfly was once widely distributed throughout England, having been recorded as common in various counties, and has also been taken in Scotland and Ireland; but it is now almost exclusively confined to the fens of Cambridgeshire, Huntingdonshire, and Norfolk. Occasionally we hear of the capture of single specimens quite outside these localities, sometimes even in most unlikely spots, where its food plant does not abound. But we know that *Machaon* is a general favourite with entomologists, and that it is sent in the pupal state, by post, to all parts of the kingdom; so that the occasional capture of the insect far beyond the borders of its haunts is probably the outcome of an escape from prison, or of the tender-heartedness of some lover of nature who could not bear to see such a beautiful creature deprived of its short but joyous, sunny flight.

You cannot hope to see this splendid butterfly on the wing unless you visit its haunts during its season—May to August; but the pupæ may be purchased for a few pence each from most of the entomological dealers; and if you obtain a few of these and watch them closely, you may be fortunate enough to see the perfect insect emerge from its case, and witness the gradual expansion of its beautiful wings.

The pupa (Plate VIII, fig. 7) itself is a most beautiful object. Its colour is a pale green, and it is fixed to its support by the tail, and further secured by a very strong silk band.

The larva (Plate VIII, fig. 1), too, is exceedingly beautiful. Its ground colour is a lovely green, and twelve velvety black rings mark the divisions between the segments. Between these are also black bars, all spotted with bright orange except the one on the second segment.

A remarkable feature of this larva is the possession of a forked, Y-shaped 'horn,' that is projected from the back, just behind the head, when the creature is alarmed. If it is gently pressed or irritated in any way, this horn is thrust out just as if it were an important weapon of defence. And perhaps it is, for it is the source of a powerful odour of fennel—one of the food plants of the caterpillar—that may possibly prove objectionable to some of its numerous enemies.

The food plants of *Machaon* are the milk parsley or hog's fennel (*Peucedanum palustre*), cow-parsnip (*Heracleum sphondylium*), and the wild angelica (*Angelica sylvestris*); but in confinement it will also partake of rue and carrot leaves.

The caterpillar of this species may be found in the fens during the greater part of the summer. It turns to a chrysalis in the autumn, and remains in this state throughout the winter, attached to the stems of reeds in the vicinity of its food plants. The perfect insect is first seen in May, and is more or less abundant from this time to the month of August.

Family—Pieridæ

This family, though known commonly as the 'Whites,' contains four British species that display beautiful tints of bright yellow or orange.

In many respects the *Pieridæ* resemble the last species. Thus the perfect insects have six fully developed legs; the caterpillars are devoid of bristles or spines; and the chrysalides are attached by means of silky webs at the 'tails,' and strong cords of the same material round the middle.

All the larvæ are also cylindrical or wormlike in shape; and their skins are either quite smooth, or are covered with very short and fine hairs, that sometimes impart a soft, velvety appearance.

The members of this family are remarkable for their partiality for certain of our cultivated plants and trees; and are, in some cases, so abundant and so voracious, that they are exceedingly destructive to certain crops.

The Black-veined White (Aporia Cratægi)

This butterfly may now be regarded as one of our rarities. At one time it was rather abundant in certain localities in England, among which may be mentioned the neighbourhoods of Cardiff and Stroud, also parts of Kent, Sussex, Hampshire, Huntingdonshire, and the Isle of Thanet; but it is to be feared that this species is nearly or quite extinct in this country. It is well, however, not to give up the search for it, and if you happen to be in one of its favoured localities of former days, you might net all the doubtful 'Whites' of large size that arouse your suspicions, liberating them again if, on inspection, they do not answer to the description of the species 'wanted.' This course becomes absolutely necessary, since the Black-veined White is hardly to be distinguished from the Common Large White while on the wing.

If you examine a number of British butterflies you will observe that in nearly all species the wings are bordered by a fringe of hair, more or less distinct. But the case is different with *Cratægi*. Here they are bordered by a black nervure, without any trace of fringe, thus giving an amount of rigidity to the edges (see Plate I, fig. 2).

The wing rays, or nervures, are very distinct—a feature that gave rise to the popular name of the butterfly. In the male they are quite or nearly black, but those of the fore wings of the female are decidedly brown in colour. At the terminations of the wing rays there are triangular patches of dark scales, the bases of which unite on the outer margins of the wings.

Another peculiar feature of this insect is the scanty distribution of scales on the wings. This is particularly so in the case of the female, whose wings are semi-transparent in consequence.

The butterfly is on the wing during June and July, at which time its eggs are laid on the hawthorn (*Cratægus Oxyacantha*) or on fruit trees—apple, pear and plum.

A vigorous search of these trees in the proper localities *may* reveal to you a nest of the gregarious larvæ, all resting under the cover of a common web of silk. These remain thus under their silken tent throughout the hottest hours of the day, and venture out to feed only during the early morning and in the evening.

When the leaves begin to fall in the autumn, they construct a more substantial web to protect themselves from the dangers of the winter, and in this they hybernate till the buds burst in the following spring. They now venture out, at first during the mildest days only, and feed voraciously on the young leaves, returning to their homes to rest. Soon, however, they gradually lose their social tendencies, till at last, when about half or three-quarters fed, they become quite solitary in their habits.

In May they are fully grown, and change to the chrysalis state on the twigs of their food trees.

The larva is black above, with two reddish stripes. The sides and under surface are grey, the former being relieved by black spiracles.

The pupa (page 45) is greenish or yellowish white, striped with bright yellow, and spotted with black.

It is probable that the reader will never meet with this insect in any of its stages. But, though it may have left us, it is still very abundant on the Continent, where it does great damage to fruit trees; and the foreign pupæ may be purchased of English dealers.

The Large White (Pieris Brassicæ)

We pass now from one of the rarest to one of the most abundant of British butterflies. Everybody has seen the 'Large White,' though we doubt whether everybody knows that this insect is not of the same species as the two other very common 'Whites.' The three—Large, Small, and Green-veined—are so much alike in general colour and markings, and so similar in their habits and in the selection of their food plants, that the non-entomological, not knowing that insects do not grow in their perfect state, may perhaps regard the larger and the smaller as older and younger members of the same species. But no—they are three distinct species, exhibiting to a careful observer many important marks by which each may be known from the other two.

On Plate I (fig. 3) will be seen a picture of the female *Brassicæ*, in which the following markings are depicted: On each fore wing—a blotch at the tip, a round spot near the centre, another round one nearer the inner margin, and a tapering spot *on* the inner margin with its point toward the base of the wing. On the hind wings there is only one spot, situated near the middle of the costal margin.

The male may be readily distinguished by the absence of the black markings on the fore wings, with the exception of those at the tips. He is also a trifle smaller than his mate.

This butterfly is double-brooded. The first brood appears in April and May, the second in July and August; and the former—the spring brood—which emerges from the chrysalides that have hybernated during the winter, have *grey* rather than black tips to the front wings.

The ova of *Brassicæ* may be found on the leaves of cabbages in every kitchen garden, also on the nasturtium, during May and July. They are pretty objects (see fig. 10), something like little bottles or sculptured vases standing on end, and are arranged either singly or in little groups.

As soon as the young larvæ are out—from ten to fifteen days after the eggs are deposited—having devoured their shells, they start feeding on the selfsame spot, and afterwards wander about, dealing out destruction as they go, till little remains of their food plant save the mere stumps and skeletons of the leaves.

The ground colour of the caterpillar is bluish green. It has a narrow yellow stripe down the middle of the back, and two similar but wider stripes along the sides; and the surface of the body is rendered somewhat rough by a number of small black warty projections, from each of which arises a short hair.

When fully grown, it creeps to some neighbouring wall or fence, up which it climbs till it reaches a sheltering ledge. Here it constructs its web and silken cord as already described (page 36), and then changes to a bluish-white chrysalis, dotted with black. The butterflies of the summer brood emerge shortly after, but the chrysalides of the next brood hybernate till the following spring.

It is remarkable that we are so plagued with 'Whites' seeing that they have so many enemies. Many of the insect-feeding birds commit fearful havoc among their larvæ, and often chase the perfect insects on the wing, but perhaps their greatest enemy is the ichneumon fly.

Look under the ledges of a wall of any kitchen garden, and you will see little clusters of oval bodies of a bright yellow colour. Most gardeners know that these are in some way or other connected with the caterpillars that do so much damage to their vegetables. They are often considered to be eggs laid by the larvæ, and are consequently killed out of pure revenge, or with a desire to save the crops from the future marauders.

No greater mistake could be made. These yellow bodies are the silken cocoons of the caterpillar's own foes. They contain the pupæ of the little flies whose larvæ have lived within the body of an unfortunate grub, and, having flourished to perfection at the expense of their host, left its almost empty and nearly lifeless carcase to die and drop to the ground just at the time when it ought to be working out its final changes. Often you may see the dying grub beside the cluster of cocoons just constructed by its deadly enemies. Should you wish to test the extent of the destructive work of these busy flies, go into your garden and collect a number of larvæ, and endeavour to rear them under cover. The probability is that only a small proportion will ever reach the final state, the others having been fatally 'stung' before you took them.

The Small White (*P. Rapæ*)

This butterfly closely resembles the last species except in point of size. The male, represented on Plate I (fig. 4), has a dark grey blotch at the tip of each fore wing, a round spot of the same colour beyond the centre of that wing, and another on the costal margin of the hind wing. The female may be distinguished by an additional spot near the anal angle of the fore wing.

Although this and the two other common butterflies (*Brassicæ* and *Napi*) that frequent our kitchen gardens are usually spoken of as 'Whites,' a glance at a few specimens will show that they are not really white at all, but exhibit delicate shades of cream and yellow, inclining sometimes to buff. The under surfaces are particularly noticeable in this respect, for here the hind wings and the tips of the fore wings display a very rich yellow.

The species we are now considering is also very variable both in its ground colour and the markings of the wings. The former is in some cases a really brilliant yellow; and the latter are in some cases entirely wanting.

Rapæ is double-brooded, the first brood appearing in April and May, and the other in July and August.

During these months the eggs may be seen in plenty on its numerous food plants, which include the cabbages and horse-radish of our gardens, also water-cress (*Nasturtium officinale*), rape (*Brassica Napus*), wild mustard (*B. Sinapis*), wild mignonette (*Reseda lutea*), and nasturtium (*Tropæolum majus*).

The eggs are conical in form—something like a sugar loaf, with ridges running from apex to base, and very delicate lines from ridge to ridge transversely.

The young larvæ often make their first meal of the shell, and then attack the food plant so voraciously that they are fully grown in about three or four weeks. In colour they are of a beautiful glaucous green, hardly distinguishable at times from the leaves on which they rest. A yellow stripe runs along the middle of the back, and lines of yellow spots adorn the sides; and the whole body is covered with very short hairs, each one arising from a minute warty projection.

The pupæ may be found during the same seasons and in the same situations as those of *Brassicæ*. They are very variable in colour. Some are of a very pale grey or putty colour, some are decidedly brown, and others of a greenish tinge; and they are often spotted and striped with dark grey or black.

The Green-veined White (*P. Napi*)

A non-observant beginner at entomological work may easily mistake this insect for the last species, for the ground colour and markings are very similar, even to the features by which the sexes are distinguished from each other; but an inspection of the under surface will give a ready means of identification, for here the wing rays are bordered with black scales which, by contrast with the rich yellow around them, often appear of a greenish hue. The butterfly receives its popular name from this circumstance.

A careful observer, however, will readily find distinguishing marks on the upper side, for here also the chief 'veins' are more or less accompanied with black scales, especially the extremities of those of the fore wings, where little triangular blotches are often distinctly formed; and the dark veining of the under surface of the hind wings frequently shows through. The under side of this insect is shown on Plate I (fig. 5).

This butterfly is not so abundant as the two preceding, but is widely distributed throughout England, and is in most parts decidedly plentiful.

The first brood (for it also is double-brooded) appears during April and May, and the second in July and August.

The eggs are very similar to those of *Rapæ*, resembling ribbed and striated sugar loaves; and the larvæ are of the same rich glaucous green, but may be identified by the black spiracles surrounded by yellow rings. In our gardens we may find both eggs and larvæ on mignonette and horse-radish; the other food plants of this species include the water-cress (*Nasturtium officinale*), winter cress (*Barbarea vulgaris*), rape (*Brassica Napus*), cuckoo-flower (*Cardamine pratensis*), and [illegible]-by-the-hedge (*Sisymbrium Alliaria*).

The pupa is gree [illegible] with small black dots.

The B [illegible] *Green-chequered White (P. Daplidice)*

There is no doubt that many butterflies migrate from one country to another across the seas; and as the Bath White is very common on the other side of the Channel, and has been taken very sparingly in England almost exclusively in the south-east, it is highly probable that the majority of those that have been captured here are specimens that have taken a voluntary trip across the water, or have been blown over during rough weather.

This butterfly is one of our greatest rarities, and the capture of a specimen in England is an event that must necessarily be recorded in our entomological literature. It seems that *Daplidice* has bred in England, for its caterpillars have been found at large on one or two occasions, so I will give a short description of the various stages of the insect, with a hope that some of my readers may be fortunate enough to meet with it.

The female butterfly is shown on Plate I, fig. 6. From this it will be observed that each of the fore wings is tipped with a rather large smoky-black blotch, in which are four white spots. A double spot of the same colour also occupies a place near the centre of the wing, and another smaller and round one lies near the anal angle. The hind wings are clouded with grey, and bordered along the hind margin with distinct smoky-black spots.

The male may be distinguished from the female by the absence of the spot near the anal angle of the fore wings, and of all the clouds and spots of the hind wings. Nevertheless the latter have a decidedly clouded appearance, but this is due to the markings of the under surface showing through them.

The under side of both sexes is most beautifully marked—the fore wings resembling the upper sides, but the hind pair chequered with a beautiful soft green on a pale yellow ground.

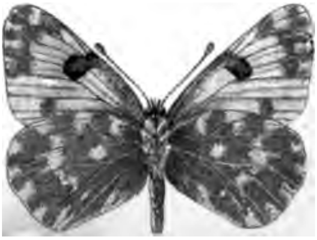


FIG. 65.—THE BATH WHITE—UNDER SIDE.

The eggs of this insect are deposited during April and May, and again in August or September—for it is, like the other 'Whites,' double-brooded—on two species of Wild Mignonette (*Reseda lutea* and *R. luteola*).

The caterpillars, which are of a bluish colour, with two yellow stripes down the back, and two others along the sides, may be *looked for* in June and September. Those of the first brood only have been taken in this country, while the others on the Continent change to the chrysalis in the autumn, and hybernate in this state throughout the winter.

The chrysalis is of a brownish colour, and closely resembles that of the Small White in form.

Those in search of this rare British insect should wander along the south-east coast, and net all the doubtful slow-flying small Whites (*Daplidice* is rather slow and heavy on the wing), and their perseverance *may* be rewarded with a prize that will ever be a reminder of a glorious catch and an eventful day. If you fail in this, and most probably you will, rather than remain a stranger to this beautiful and interesting insect, fill up the blank in your cabinet with a foreign specimen, which can be obtained at any time for a few pence, but be careful to label it 'not British,' in order that your brother collectors may not be deceived, or be led to make any unnecessary inquiries.

The Orange Tip (*Euchloë Cardamines*)

No one could possibly mistake the male of this species for any other British butterfly, the popular name alone giving quite sufficient information for its identification, but the female Orange Tip is *not* tipped with orange, and its markings, both above and beneath, resemble those of *Daplidice* so nearly that the same written description might apply almost equally well to both.

On Plate I (fig. 7) is shown the upper side of the male, and just opposite it (fig. 8) the under surface of the same. The female is usually a little larger than her mate, and is marked similarly on both sides except that the bright orange blotch is entirely wanting. She may always be distinguished from *Daplidice* by the smaller size of the white spots that break the dark blotch at the tip of the fore wing; also by the very small size of the dark spot in the centre of the same wing. The green chequerings of the under side of the hind wings are also more sharply defined, and the insect is generally of a lighter build.

Like many other butterfl [illegible] ange Tip is subject to variations in colouring. Som [illegible] but bright yellow takes the place of the white [illegible] range blotch of the male is [illegible] uppe [illegible] wer surface only.

[illegible] ingle-brooded insect, and is essentially a ature of the spring, at which time it may be found in abundance in lanes, meadows, and clearings in woods throughout the British Isles. Its flight is so light and airy that even the female may easily be distinguished from other Whites when on the wing, while the brilliant orange of the male, intensified by the bright rays of the spring sun, may be identified at some considerable distance.

The food plants of *Cardamines* include the cuckoo-flower (*Cardamine pratensis*) and the bitter cress (*C. impatiens*), after which the insect is named, also water-cress (*Nasturtium officinale*), winter cress (*Barbarea vulgaris*), rock cress (*Arabis perfoliata*), hedge mustard (*Sisymbrium officinale*), Jack-by-the-hedge (*S. Alliaria*), wild mustard (*Brassica Sinapis*), &c., and the eggs of the butterfly may be found on these during May and June.

The caterpillar (Plate VIII, fig. 2) is green, with a white stripe on each side, and its body is covered with short hair. In July it is fully grown, and ascends a stem of the food plant to prepare itself for its long winter sleep.

The chrysalis (Plate VIII, fig. 8) is a very peculiar object. Both ends are much elongated and sharply pointed; and the foremost extremity stands out at an angle with the stem to which it is attached.

This butterfly should be looked for during April and May, but in mild seasons it may often be met with in March.

The Wood White (*Leucophasia Sinapis*)

The distinguishing feature of this butterfly (see Plate II, fig. 1) is the extreme lightness and delicacy of its build. Its wings are narrow, and rounded at the tips; and the only mark to relieve the white ground of the upper side is a squarish blotch at the tip of the fore wing, and even this is either very indistinct or entirely absent in the female. The under surface is clouded with a pale greenish tint.

This insect may be looked for in May and again in August, in paths and clearings in woods, where it moves along with a slow but steady flight, hardly ever seeming to rest for a moment. It is not by any means a common butterfly, but is very widely distributed, and sometimes appears in considerable numbers in certain favoured spots. Among the localities recorded may be mentioned Torquay, Exeter, Plymouth, South Dorset, New Forest, Reading, Darent Woods, Morecambe Bay, Haslemere, Windermere, &c.

The caterpillar is of a beautiful green colour, and is covered with short whitish hairs. A darker green stripe runs down the middle of the back, and a bright yellow stripe along each side. Its food plants are the tufted vetch (*Vicia Cracca*), bird's-foot trefoil (*Lotus corniculatus* and *L. pilosus*), bitter vetch (*Lathyrus tuberosus*), and the everlasting pea (*L. sylvestris*).

The chrysalis is a very beautiful object. Its colour is a delicate green, tinged with pink; and the wing-cases project in beautiful curves much beyond the general surface.

The Pale Clouded Yellow (*Colias Hyale*)

The ground colour of this butterfly (Plate II, fig. 2) is very variable. It is usually a sulphury yellow, and on this account the insect is commonly known as the Clouded Brimstone; but sometimes the yellow is exceedingly pale—almost white—and tinged with green.

A very large black blotch, broken by indefinite patches of the ground colour, fills up the tip of each fore wing, and extends to the anal angle, becoming narrower as it approaches this point. A black oval spot lies just above the middle of this wing.

The hind wings are bordered with black, and a conspicuous spot of deep yellow lies very near the centre of each.

The antennæ are rather short, compared with those of the preceding members of this family, and are distinguished by their reddish-brown colour.

The male and female of this species are similarly marked, but the ground colour of the latter is commonly paler.

This is not by any [illegible] common butterfly with us, though it is very plentiful [illegible] side of the Channel; but it has a way of taking us by [illegible] in certain seasons, and then almost neglecting us for [illegible] together.

Its head quarters are certainly the coasts of Kent and Sussex, but it has been taken in considerable numbers as far west as Cornwall, and also to a less extent in some of the midland and northern counties. It is particularly fond of lucerne and clover fields, especially those that are situated close to the sea cliffs; and often it may be seen flying over the beach, sometimes even flitting over the breakers away from land [illegible] it disappears in the distance. This maritime [illegible]*yale* makes it probable that a large number of the [illegible] on our south-east coasts have [illegible] of the Channel.

[illegible] spring, by females that have hybernated [illegible] the [illegible], on various leguminous plants, including the lucerne (*Medicago sativa*), black medick (*M. lupulina*), purple and Dutch clovers (*Trifolium pratense* and *T. repens*), and the bird's-foot trefoil (*Lotus corniculatus*), and on these plants you may search for the larva, though it can scarcely be said that you are likely to find it.

The caterpillar is green, with black dots, and a yellowish stripe on each side. When fully grown it ascends a stem of its food plant and changes to a green chrysalis with yellow stripes.

Hyale is single-brooded in England, although two broods regularly appear on the Continent. In our country the perfect insects emerge during July and August. Many of these die before the approach of winter; but, as we have already observed, some hybernate and deposit their eggs in the following spring.

The Clouded Yellow (*Colias Edusa*)

Not only are this and the last species similarly named, but a glance at the figures will show that they much resemble each other in appearance; and we shall also learn presently that in their habits and life history they have much in common.

The male *Edusa* is shown on Plate II (fig. 3), and when we compare it with its relative on the opposite side, we are at once struck with the superior richness of the brilliant orange or saffron of the ground colour. The black border of both fore and hind wings is also denser, wider, and more extensive. The whole of the yellow area of the hind wings is dusted more or less with black scales, with the exception of a round central spot of deep orange, corresponding with the orange spots on the hind wings of *Hyale*.

The female, which is shown in the accompanying woodcut, is generally larger than the male, and is further distinguished by the very pale yellow spots that break the black border of both pairs of wings.

Edusa further resembles *Hyale* in the reddish colour of the antennæ; and, in both the species, the red legs form a pleasing contrast with the yellow furry surface of the under side of the thorax.

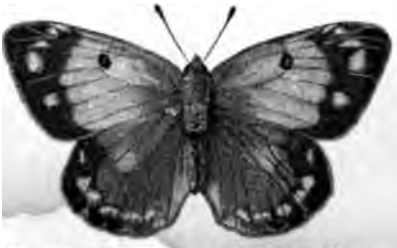


Fig. 66.—The Clouded Yellow—Female.

There is a variety of the female of this butterfly, in which the ground colour is a *very pale* yellow, almost white. The hind wings are more thickly dusted with black scales than in the normal insect, and the orange spots of these wings show up much more conspicuously from the contrast with their surroundings.

It is usual to apply distinct names to constant varieties of species —names that are to be added to the ordinary title. In this particular case the distinguishing name is *Helice*, so that we should speak of the variety of *Edusa* above mentioned as:

Colias Edusa, var. *Helice*

Like *Hyale*, *Edusa* is particularly capricious in its appearance. In certain summers it absolutely swarms in favourite localities, while during the intervals between such remarkable appearances—usually several years—it is positively scarce. The last favoured season was the summer of '92, during which (from the beginning of August to the end of the summer) dozens might easily have been caught in an hour or two; in fact, so plentiful were they in many places, that they were continuously in sight, often several at one time.

Those in search of this insect should repair to the south coast, especially the south-east, and where lucerne and clover fields are in flower. It has very decided maritime tendencies, and may often be seen flying over the cliffs and beaches, and even skipping over the breakers; but, at the same time, it is more or less plentiful in many inland districts. It has been taken in many parts of Ireland and Scotland, particularly along the southern coasts of these countries; but its head quarters are undoubtedly the southern cliffs of England, from Cornwall to Kent, and also the hilly inland districts of the south-eastern counties.

Edusa catching is very lively sport, and is likely to prove sufficient for any lover of outdoor exercise under a scorching sun; for this butterfly is not only very powerful on the wing, but its flights are usually long, so that a good run is often absolutely necessary in order to e it. On very hilly ground, such as *Edusa* loves, chase is ss, and then it is necessary to resort to stratagem. In the best plan is to make a very cautious appro has been observed to settle, -stroke of the net.

; May and June by a few females that

The cat be found in June and July on its food plants, the h are the bird's-foot trefoil (*Lotus corniculatus*), and e and Dutch clovers (*Trifolium pratense* and *T. repens*). Its colour is grass-green, and it is marked with a narrow whitish stripe on each side, which is broken by the yellow of the spiracles.

The chrysalis is of a pale yellowish green, and is marked with yellow stripes and reddish-brown dots.

The Brimstone (Gonopteryx Rhamni)

This, the last member of the present family, is remarkable for the graceful outline of its wings.. The costal margins of the fore pair are most beautifully arched, and both pairs are sharply angled on the hind margins. This latter characteristic is quite unique among British butterflies, though we shall presently meet with instances of angular projections on hind wings only.

The ground colour of the male (Plate II, fig. 4) is a rich sulphury yellow, with a greenish tinge. That of the female is a very pale greenish yellow. The only conspicuous markings are small saffron spots, one near the centre of each wing. The antennæ are red, short, and beautifully curved; but, unlike the two preceding species, the legs are almost white.

The eggs of this butterfly are laid in April on the two species of buckthorn (*Rhamnus catharticus* and *R. Frangula*) by the females that have successfully weathered the winter. They are of a bright yellow colour, and are usually hatched in about a fortnight.

The body of the caterpillar is green, and it is thickly covered with little black wart-like projections. A pale stripe also runs along each side. During May and June it may be found on its food plants, and toward the end of the latter month it attaches itself by a silken carpet and belt to the under side of one of the leaves.

The chrysalis is of a very peculiar shape, the body being curved, and the wing cases standing out prominently beyond the general surface. Its colour is a bright apple green marked with yellow, and it is so transparent that certain of the structures can be seen through its skin.

The perfect insect emerges in about three weeks after the change to the chrysalis; and may be looked for from July to the end of the summer. This period may be regarded as the best time in which to hunt for *Rhamni*, but it is to be noted that this butterfly makes its appearance during all months of the year, even though it is single-brooded.

A large number seem to hybernate, and their winter sleep is so light that the welcome rays of the sun on a mild day, even during the bleak months of November to February, will often call them out from their hiding places. Then, as a rule, the hybernating butterflies do not live long after depositing their eggs for the future brood; but the Brimstone often lives on till its offspring have themselves attained the perfect state, so that it is possible to capture the insects of two different years both on the same day. In such a case it is generally easy to distinguish between the two, for the newly emerged specimens are beautifully bright and fresh in colour, while those of the previous year are more or less faded and worn, their wings being often semi-transparent through the loss of scales, and frequently disfigured by the stains of mildew.

CHAPTER XIII

THE FRITILLARIES, VANESSAS, AND THE PURPLE EMPEROR

Family—NYMPHALIDÆ

WE now come to a rather large family, which contains some of our largest and most brilliant butterflies. Some of them display the most gaudy colours, and others exhibit patches of a beautiful metallic lustre.

If you were to see all the members of this family side by side, they might strike you as being so varied in their appearance that you would wonder why they are all placed in one family group. But, were you to see, in [illegible] he perfect insects, all their larvæ and chrysalid[illegible] be made clear at once, for [illegible] arlier stag[illegible] each other in certain points [illegible] e former [illegible]e all provided with peculiar [illegible] e all more or less angular, and are all sus- [illegible]ed to a silken carpet by means of hooks at the tip of the abdomen, and have no belt as we have observed in the case of the *Pieridæ*.

The perfect insects, too, although so varied in colouring, are alike in that they have only four walking legs, the first pair being so imperfectly developed as to be useless for this purpose.

This family includes the Fritillaries and the Vanessas.

The Small Pearl-bordered Fritillary (Argynnis Selene)

The interesting group of butterflies known as the Fritillaries vary considerably in size, but are remarkably uniform in the ground colour of the wings, which, in all cases, is a rich golden or sienna brown; and this ground is chequered with darker colours in such a manner as to remind one of the petals of the wild flower known as the Snake's Head or Fritillary—hence the popular name of the group.

The Small Pearl-bordered, our first example, is one of the lesser Fritillaries, and is shown in Plate II (fig. 5).

The arrangement of the black markings on the upper surface will be readily made out from the coloured plate, but the pattern of the under side will require a little special notice, for it is here, as with the other Fritillaries, that we find the chief marks by which we identify the species. On this side (fig. 67) the fore wings are light orange brown, with a patch of darker brown near the tips, and spotted with a dull black. The hind wings have the light brown displaced by a very warm chestnut tint, some yellow, and bright silvery spots.

Seven silvery spots of triangular form border the hind margin. A large one occupies the centre of the wing, and ten others are somewhat irregularly scattered over other parts of the wing—five between the central spot and the hind margin, and five between it and the costa.

All the spots on these wings, whether yellow, chestnut, or silver, are bordered by a narrow black line.

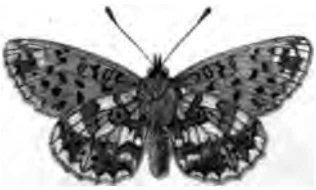


FIG. 67.—THE SMALL PEARL-BORDERED FRITILLARY—UNDER SIDE.

Selene is not a very abundant butterfly, but is widely distributed in England, and is also found in parts of Scotland. Its favourite resorts are clearings in woods, especially those of Kent and other southern counties.

It appears in May and June, in which latter month it deposits its eggs on the dog violet (*Viola canina*).

The caterpillar is not fully grown at the end of the summer, and hybernates during the winter among the roots of its food plant. In the following spring it emerges again, and feeds till May, when it changes to the chrysalis on a stem. It is less than an inch long when fully grown, and is of a dark-brown colour. Six rows of hairy spines are arranged longitudinally on its body.

The chrysalis is greyish brown, and has a number of very short projections corresponding with the spines of the caterpillar.

The Pearl-bordered Fritillary (Argynnis Euphrosyne)

There is very little difference in the size of this and that of the last species, but *Euphrosyne* (Plate II, fig. 6) is generally a trifle larger. The two butterflies are also very similar in appearance; indeed, they are so much alike on the upper side that it is impossible to decide on the name of either without an examination of the under surface.

Euphrosyne has a border of seven triangular silver spots on each hind wing, exactly corresponding with those of *Selene*. It has also the large central spot of silver. But, beside these, there is *only one* other, and that is situated in the basal angle. Thus there are only nine silvery or pearly spots on each hind wing of *Euphrosyne*, while there are seventeen on *Selene*. This will form a ready means of distinguishing between the two species.

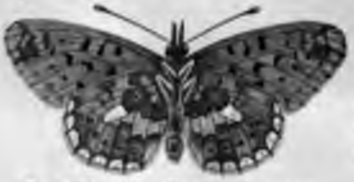


FIG. 68.—THE PEARL-BORDERED FRITILLARY—UNDER S

The seasons and localities this butterfly correspond y closely with those of the last species, but it ion, and may be found in in r woods during May and

cate , feeds on the same plant (dog violet) as ne. It is black, with whitish lines along the sides; and is provided with a number of bristly spines.

The chrysalis is of a grey-brown colour, with small dots of a paler tint on the wing cases; and its body has a number of short conical projections exactly corresponding with the spines of the caterpillar.

The Queen of Spain Fritillary (Argynnis Latona)

We now pass from the commonest to the rarest and most prized of our wood butterflies—The Queen of Spain (Plate II, fig. 7). This royal personage is not easily mistaken for any of the meaner Fritillaries even when the upper surface only is examined, as the concave hind margins of the fore wings serve as an almost conclusive mark of distinction. The rich tawny brown of this side is boldly marked with black, and the long hairs and scales of the bases of the wings are tinged with green.

The under side presents a most beautiful appearance. Here the ground colour is paler than that of the upper side. The fore wings are spotted with black, and have a few small patches of silver at the tips. Each hind wing has no fewer than twenty-four bright silvery spots. Seven of these, mostly of large size, adorn the hind margin, and above each of these is a small one in the middle of a little patch of dark brown. The arrangement of the others is not quite so easily described, but may be readily made out from our illustration.

This rare gem among British butterflies has been taken in many localities, but in very small numbers. Seeing that it is a common insect on the other side of the Channel, and that the British captures have been made chiefly in the Isle of Wight and on the south coast, I am inclined to believe that many of the highly valued genuine Britishers have no right to their title, but are visitors that have spent only a few days within our shores, having flown or been blown across the sea.

It is not likely that many of my readers will ever meet with *Latona* during their rambles in our own country, and if they are anxious to have the species represented in their collections, they will probably have to purchase either a British or a foreign specimen, the former of which will command a very high price, while the latter may be obtained for three or four pence.

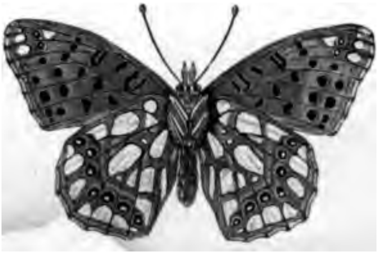


Fig. 69.—The Queen of Spain Fritillary—Under Side.

The perfect insect may be looked for in August and September, during which time the eggs are laid on the leaves of violets and the heartsease (*Viola canina*, *V. odorata*, and *V. tricolor*).

The caterpillar is brown, with numerous yellowish spines, and has three whitish or yellowish stripes—one down the middle of the back and one along each side. It hybernates during the winter, and is fully grown in the following June or July. I hope that my reader will be so fortunate as to secure either this or some other stage of this rare and beautiful insect. The chances are decidedly against him, but that is no reason why he should abstain from a vigorous search when he happens to be 'doing' the southern counties.

The Dark-green Fritillary (*Argynnis Aglaia*)

This butterfly is larger than *Latona*, as will be seen by reference to Plate II, fig. 8. Its colour is, as usual with the Fritillaries, a tawny brown with black markings. The female is usually larger than the male, and she is further distinguished by the ground colour being darker and the black markings larger.

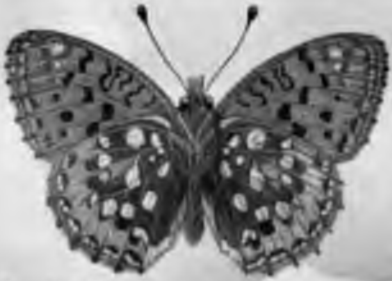


Fig. 70.—The Dark-green Fritillary—Under Side.

The under side of the fore wings is very similar in colour and markings to the upper, but there are silvery spots near the tips. The hind wings are beautifully tinted with olive green and brown, and studded with silver. The arrangement of the latter is not easily described, but is accurately represented in the accompanying woodcut.

The favourite resorts of this insect are wooded spots, and also heaths and downs clad with heather or ferns, where its food plant (the dog violet) lies scattered; but it seems to be less partial to woods than the other Fritillaries. It is very widely distributed throughout England, and is common in parts of Scotland and Ireland.

The perfect insect is on the wing in July and early August.

The caterpillar first appears toward the end of August, and commences its period of hybernation among the roots of its food plant before it has grown to any considerable size. It comes out again in the spring, and continues to feed till the beginning or middle of July, and then changes to the chrysalis state, after protecting itself by binding three or four leaves together.

Its colour is a velvety black, with dark and glossy grey between the segments. There is a double yellow line along the back, and a thin line of orange yellow on each side below the spiracles. It has a number of black hairy spines, arranged in six longitudinal rows.

The chrysalis is of a shiny black colour, with brownish abdomen; and the conical projections are black with yellow tips.

The High-brown Fritillary (Argynnis Adippe)

The upper side of this butterfly is so much like that of *Aglaia* that it would be difficult indeed to give a written description of one that did not almost equally well apply to the other; so we look to the under surface for the chief marks by which we can distinguish between them.

On this side (Plate III, fig. 1) the fore wings are much the same as those of *Aglaia*. The hind wings, too, are very similarly coloured and marked, but here we have a distinguishing feature in a row of rust-red spots with silvery centres, just inside the silver border of the hind margin.

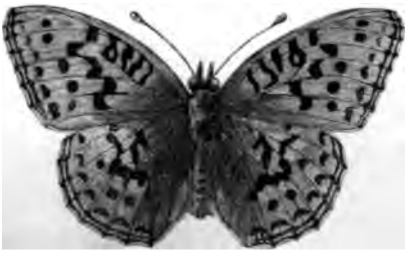


FIG. 71.—THE HIGH-BROWN FRITILLARY.

This butterfly is common in open spaces of woods in many parts of England, more particularly in the south, and seems to be also fond of hilly heaths and moors.

It is on the wing in July, and, towards the end of this month and in the beginning of August, the eggs are laid on the leaves of the dog violet (*Viola canina*) and heartsease (*V. tricolor*).

The young caterpillar emerges about two weeks later, and feeds only for a short time before it seeks out its winter quarters among the dead leaves at the root of its food plant. The feeding is resumed in the spring, and continued till the month of June, when it is fully grown. At this time it is about an inch and a half long. Its head is black, and its body pinkish brown. A white line extends down the back, but is interrupted by several black marks. The spines, of which there are six rows, are white, with pinkish tips.

The Silver-washed Fritillary (Argynnis Paphia)

This beautiful and noble butterfly is the largest of the Fritillaries, and the most powerful on the wing. During the latter part of June and throughout July it may be seen gracefully sweeping through the trees and undergrowth of woods, often settling down on a favourite flower for a short time. So strong is its flight that it is useless to attempt to pursue it for any distance. Sometimes it will sail along a wooded path, followed at short intervals by others of its species, and may be taken in the net as it passes. But perhaps the most successful method of netting *Paphia* is to wait till it has settled, and then secure it by a quick upward or side stroke of the net. If then you miss your aim, off it will dart, sailing over the tree tops till, in a very short time, it is quite out of sight.

The upper side of this butterfly is shown in Plate III, fig. 2, where the general arrangement of the black spots on the rich orange-brown ground is carefully marked. There is a considerable difference between the male and female of this species. The figure on Plate III represents the male. The female does not possess the broad black lines that follow the course of the veins of the fore wings; the basal portions of all four wings are also tinged with a rich olive-brown colour, often with a decided tendency to green; and the black spots of all the wings are larger.

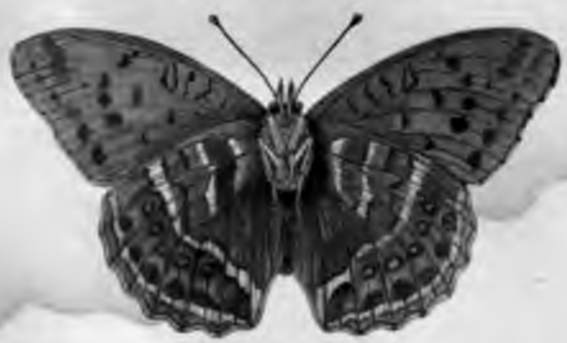


Fig. 72.—The Silver-washed Fritillary—Under Side.

The under side is particularly rich in its decorations. The front wings are of the usual orange brown, chequered with black. The hind wings are partly brown and partly orange, and exhibit beautiful greenish reflections. They have also two bars of silver, and a silvery spot in the basal angle, all with rather indefinite outlines.

The female lays her eggs late in July on the food plants (*Viola canina* and *V. odorata*) or on the moss that surrounds them.

About two weeks later the young caterpillar is out and feeding; and then, after a few more weeks, while it is yet very small, it hides among the dead leaves at the roots. Early in the spring it resumes its feeding, and is full grown at the end of May.

The colour of the caterpillar (Plate VIII, fig. 8) is black, and there are two yellow lines along the back, separated by a black stripe, also one yellowish line on each side. Its body is adorned with reddish-brown spines, two of which, situated just behind the head, are longer than the others.

The chrysalis (Plate VIII, fig. 9) is greyish, marked with metallic spots, and has a number of angular projections representing the spines of the larva.

Paphia is to be met with in woods in all parts of England and Wales. It has also been observed in Ireland, but is rarely seen in Scotland.

The Greasy Fritillary (*Melitæa Aurinia*)

Unlike the other Fritillaries, this species (Plate III, fig. 8) exhibits a variety of shades on the upper surface. A broad band of sienna brown stretches across each wing, near to and parallel with the hind margin. The other parts of the wings are marked with patches of sienna, orange, and yellow, separated by black lines and bands. The margins are all black, and inside the broader margin of the hind wing is a row of six very pale yellow spots. The broad sienna band of the hind wing is also divided by narrow black lines into seven parts, six of which have black centres.

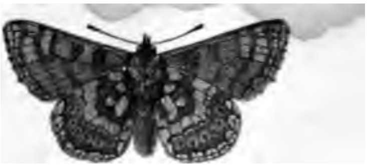


FIG. 73.—THE GREASY FRITILLARY—UNDER SIDE.

The under surface of the fore wings has indefinite yellowish and tawny patches, which look as if they had been greased and smeared. The hind wings are marked with pale yellow and deep orange; a broad band of the latter, near the hind margin, is divided into segments, each of which has a yellow spot with black in the centre.

This is a very local insect, although it is widely distributed throughout England and Wales. It also occurs sparingly in Scotland and Ireland. Its food plants are the honeysuckle (*Lonicera*

Periclymenum), devil's-bit scabious (*Scabiosa succisa*), and the plantain (*Plantago*); and its chief resorts are damp meadows and marshy places, where these plants (more especially the scabious) abound.

The butterfly appears about the end of April or in June.

The caterpillars emerge from the eggs towards the end of the latter month, and always feed in groups under the cover of a silken web. Like the preceding species they hybernate during the winter, and commence feeding again in the spring. They are fully grown about the end of April.

In colour the caterpillar is velvety black, dotted with white, and its body is covered with short bristly spines. When fully fed it seeks the shelter of a curled leaf or dense herbage, suspends itself by the hind claspers to a silken carpet, and then changes to a creamy white chrysalis with black dots.

The Glanville Fritillary (*Melitæa Cinxia*)

The pattern of the upper side of this Fritillary (Plate III, fig. 4) is very similar to that of *Aurinia*, but the ground colour is a uniform tawny brown, and the fringes of the wings are of a very pale straw colour, barred with black.

The under side of the fore wings is tawny brown, with straw-coloured tips bearing black markings. The hind wings have four alternate bands of brown and straw colour, and a patch of straw colour at the base. The marginal yellow band has six or seven black spots. The brown band next to it is divided into six segments with black borders, each with a black spot. The next yellow band has also a row of black spots. The inner fulvous band is very irregular; and inside this is the yellow base with six spots.

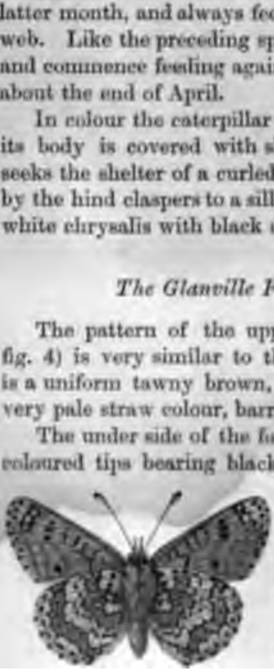


Fig. 74.—The Glanville Fritillary Under Side.

This is another local insect—very local indeed, for it seems to have been found only in a few spots outside its head quarters, the Isle of Wight. Those in search of it should carefully scan the rough cliffy parts of the island, wherever the species of plantain (*Plantago Coronopus* and *P. maritima*) are plentiful, these being the food plants of the larvæ. It first appears on the wing in May, but may be found till the end of June.

The caterpillars, which are black and spiny, with reddish head and legs, begin to feed in August, and as soon as the chilly weather sets in they hybernate in groups under the cover of a tent constructed by binding together leaves or blades of grass. In the spring they start out again, and feed till the end of April, at which time they change to dark brownish and smooth chrysalides.

The Heath Fritillary (*Melitæa Athalia*)

Both the upper and under sides of this butterfly are shown on Plate III (figs. 5 and 6), and it will be observed from these that its general appearance is very similar to that of *Cinxia.*

The upper surface is of the same tawny brown, barred and striped with black, and the fringes of the wings are pale yellow, interrupted by small patches of black.

The under surface of the fore wings has the same ground colour with the exception of the tips, which are yellow; and the whole is marked with black, as in the illustration. The hind wings are pale yellow, with two broad bands of brown corresponding with those of *Cinxia* ; but a series of black double arches along the hind margin and the *absence* of rows of black spots serve to distinguish this species from the last.

Athalia is another local butterfly, but is sometimes found in abundance in the spots which it frequents. It is met with chiefly in the open spaces of woods along the south coast and for some distance inland. Devon, Cornwall, Sussex, and Kent seem to be the most favoured counties; and London entomologists would do well to search for it in Epping Forest.

The butterfly deposits its eggs during June and July, on several different food plants, the chief of which are the greater and narrow-leaved plantains (*Plantago major* and *P. lanceolata*), foxglove (*Digitalis purpurea*), two species of cow-wheat (*Melampyrum pratense* and *M. sylvaticum*), wood sage (*Teucrium Scorodonia*), and the germander speedwell (*Veronica Chamædrys*), and the young caterpillars, after feeding for only a week or two, commence their period of hybernation. They resume their feeding in April, and change to the pupal state about the end of May.

The colour of the caterpillar is velvety black, finely dotted with white, and the spines are yellow or orange, tipped with white.

The chrysalis is creamy white, banded and patched with orange and black, and is suspended by anal hooks from a silken carpet which the caterpillar had spun on the leaf of the food plant.

The Comma (Vanessa C-Album)

Leaving the Fritillaries, we now come to a genus (Vanessa) that includes seven most beautiful butterflies, some of which are so common as to be known to almost everybody.

It will be observed that this genus belongs to the same family as the Fritillaries, and we may therefore expect to find that the two groups possess features in common. A slight examination of a few in their different stages will show that this is so. Thus, the perfect insects have only four walking legs, the caterpillars are all spiny, and the chrysalides are angular.

There is another feature concerning the chrysalides worthy of note. Like some of the pupæ of the Fritillaries, they are adorned more or less with brilliant metallic spots, sometimes of a rich golden hue, and sometimes resembling burnished silver. Now the word 'chrysalis,' which, as we have already seen, is derived from a Greek word meaning 'gold,' was originally applied to the pupæ of some of the Vanessas, on account of their metallic decorations, but it has since been extended to the pupæ of all the Lepidoptera, and also to other orders of insects, even though the greater number of them display no tints of the precious metal.

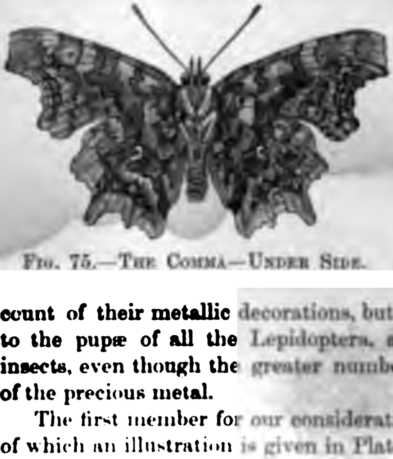


FIG. 75.—THE COMMA—UNDER SIDE.

The first member for our consideration is the Comma Butterfly, of which an illustration is given in Plate III, fig. 7. No one could mistake this beautiful butterfly for any other British species, for its wings of rich orange brown, with black and dark-brown markings, are so irregularly scalloped on the hind margins that they present a somewhat ragged appearance. Its name is derived from the fact that a white mark something like the letter C, or, as some have it, like a comma, is distinctly painted on the dark brown of the under side.

This butterfly generally emerges from the chrysalis late in the summer—August and September, but it is often seen earlier, and frequently as late as October. It is a great lover of sweets, and may be found settled on various flowers and fruits. Its chief food plants are the hop (*Humulus Lupulus*), red currant (*Ribes rubrum*), stinging nettle (*Urtica dioica*), and the Elm (*Ulmus campestris*).

It is very abundant in certain districts where hops are grown, but seems to avoid those counties that border the sea. It is widely distributed in the midland counties, and extends to the north of England and into Scotland, but is very capricious in its appearance in many parts.

The eggs are laid in May by females that have hybernated through the winter, and the caterpillars may be found feeding during July and August.

The caterpillar is coloured grey and brown, with a black head, and a broad white stripe down the back of the hindermost segments. The body is armed with a number of spines, some of which are white, and others pale brown.

The chrysalis is a very peculiar object, having two ear-like projections extending forwards from the sides of the head. It has a number of angular projections, and is of an umber-brown colour, finely netted with black lines, and having several spots of a brilliant metallic lustre.

The Large Tortoiseshell (*Vanessa Polychloros*)

Our two tortoiseshells—large and small—are very similar in their colour and markings, and moreover are not always to be distinguished by their size, for specimens of the larger species are sometimes even inferior in this respect to the largest of the smaller species; so, to avoid all risks of mistaken identity, we must look for more reliable marks of distinction between them.

The present species is figured on Plate III (fig. 8), where it will be seen that the ground colour of dark tawny brown is spotted and bordered with black. The border of the hind wings contains a row of crescent-shaped blue spots. The costal margin of the fore wings, between the black patches, is decidedly lighter than the general ground, and is yellow rather than brown. It will be noticed, too, that a black spot lies very near the anal angle of these wings.

The under surface, though by no means brilliant, exhibits a rich blending of various shades of brown.

This butterfly is not known to occur in either Scotland or Ireland, and is by no means common in England. Its chief localities are in the midland and eastern counties.

The perfect insect generally appears about the middle of July, and after spending a month or six weeks on the wing, seeks out a sheltered spot in which to spend the winter. In the spring April or May—it again takes to flight, and during the latter month the females are busily engaged in the deposition of their eggs.

The caterpillar feeds on the two species of elm (*Ulmus campestris* and *U. montana*), willow (*Salix alba*), sallow (*S. Caprea*), osier (*S. viminalis*), aspen (*Populus tremula*), and certain fruit trees; and is full grown about midsummer. It is of a tawny grey colour, with a black stripe on each side, and is covered with very small wart-like projections, and the spines are branched.

The chrysalis is of a dull pinkish colour, and may be found on tree trunks, palings, and walls, about the end of June, suspended from a silken carpet by means of its anal hooks.

The Small Tortoiseshell (*Vanessa Urticæ*)

Urticæ (Plate III, fig. 9) may be distinguished from *Polychloros* by the *absence* of the black spot in the anal angle of the fore wings of the latter. It has also a white spot near the tip of each fore wing- between the black border and the first black costal patch. The whole of the base of the hind wing is also black, and the ground colour is decidedly brighter.

It is one of the commonest of all British butterflies, and is to be found more or less abundantly in nearly all parts of the British Isles.

The hybernated perfect insects come out early in the spring, and lay their eggs in close irregular clusters on nettles (*Urtica dioica* and *U. urens*). Shortly after the gregarious caterpillars may be found on these plants in dense masses. They change to the chrysalis state about the end of May, and from this time there is a continuous succession of butterflies till the end of the summer.

The later specimens, which do not emerge till September or October, spend [illegible] time on the wing, and then hybernate till the spring, giving rise to the first brood of the following season.

The caterpillar of this species is black above and greyish beneath.

It is thickly covered with yellow dots, which are so close together on the back as to form two yellowish stripes, separated only by a fine black line. There are also two yellowish stripes along each side; and the body, as with the rest of this genus, is spiny, the spines in this case being black or very dark green.

The chrysalis is brownish, and spotted with burnished gold in variable quantity—sometimes so plentifully as to cover the greater part of the surface.

The Peacock (*Vanessa Io*)

This is another of our commonest and most beautiful butterflies. Its general appearance is such that it cannot possibly be mistaken for any other. The upper side (Plate IV, fig. 1) is rendered conspicuous by the beautiful eye-like marks at the costal angles of all four wings; and the under surface is very richly decorated with a fine arrangement of black and dark-brown patches and streaks.

Io is very abundant in all parts of England, and is well known in many parts of Scotland and Ireland, but seems to be rare in the extreme north of both of these countries.

Its food plant is the stinging nettle (*Urtica dioica*), and on this the eggs are laid in April by females that have hybernated during the winter.

The caterpillar is full grown at the end of June or beginning of July. It is black, with numerous minute white wart-like projections. Its spines also are black, and its claspers brown.

The chrysalis may be found suspended by the tail on some object in the neighbourhood of the food plant, or sometimes on the food plant itself. It is of a greenish colour, with yellowish patches, but turns darker as the time approaches for the emerging of the perfect insect.

This event takes place in August, and the butterfly, after a brief period on the wing, seeks out a sheltered spot for its winter nap.

The Camberwell Beauty (*Vanessa Antiopa*)

The reader will be fortunate if he succeeds in netting a specimen of this highly prized British butterfly. It derives its popular name from the fact that a few were taken in Camberwell about a hundred and fifty years ago; and since that time it has been seen and taken in variable numbers in several parts of England. So widely distributed, indeed, are its localities, and so few, comparatively, its appearances, that it would be useless to attempt to give any hints as to where it may be looked for. It is, however, a very common butterfly in many continental countries, and foreign specimens may be obtained from any dealer in entomological wares for a few pence each.

This rare British gem is illustrated in fig. 2 of Plate IV. Here it will be seen that nearly the whole of the surface is covered with a rich velvety purple brown, bordered with a black band containing blue spots; and outside this is a border of white, finely dotted and streaked with black. The continental specimens may be easily distinguished from the genuine Britishers by a darker border with a decidedly yellow tinge.

The eggs of this species are generally laid on the young leaves of the willow (*Salix alba*), in the spring, by females that have hybernated, but sometimes the nettle (*Urtica dioica*) and the birch (*Betula alba*) are selected for the food of the larvæ.

The caterpillar is black and spiny, and has a row of seven rather large reddish-brown spots on the back, commencing at the fifth segment.

The chrysalis, like those of the other members of this family, is angular and suspended by the 'tail.' The perfect insect appears in August, and may be seen from that month till October.

The Red Admiral (*Vanessa Atalanta*)

There seems to be a tendency with many to under-estimate the beauty of certain natural objects because they happen to be so very common, and this is particularly the case with some of our most familiar butterflies. The beautiful Red Admiral (Plate IV, fig. 3) may possibly suffer in this respect; for, not only is it one of the commonest of our butterflies, but it fearlessly hovers among the flowers of our gardens, often venturing into the very heart of thickly populated towns.

The bright scarlet bands and white blotches of this gorgeous insect stand out boldly on the rich velvety black ground of the wings, and the additional touches of blue in the anal angles of the hind wings add to the effect. The under side of the fore wings is somewhat similar to the upper surface, but is relieved by brown and blue; and this side of the hind wings presents most beautiful and indescribable blendings of various shades of brown, grey, and pink. The female may be distinguished by the presence of a small white spot on the scarlet band of the fore wing.

The eggs are deposited singly on the nettle (*Urtica dioica*) in spring by females that have hybernated through the winter.

The caterpillar always feeds under the cover of a tent made by drawing leaves together. It is spiny, and its colour is usually a greenish or yellowish grey, spotted with black, and striped along the sides with white or yellow. When fully grown it bites the stem of the nettle nearly through a few inches from the top, so that the upper part of the plant bends over the withers. It then constructs a commodious tent by binding the leaves of this drooping portion together, and suspends itself from the roof of this strange home to undergo its metamorphoses.

The change to the chrysalis state takes place in July or August, and the perfect insect may be seen during August, September, and October in almost every part of the British Isles.

The Painted Lady (*Vanessa Cardui*)

Although the time of appearance of this butterfly generally corresponds with that of the last species, yet it is exceedingly variable, so much so that it is impossible to give any fixed period as its season. It is, moreover, very capricious with regard to its localities and its numbers. Sometimes it will turn up unexpectedly in positive abundance in certain localities where previously it had been a mere straggler; and then, for some unaccountable reason, become comparatively scarce for several successive seasons.

The upper surface of this beauty (Plate IV, fig. 4) is adorned with pale red, orange, and black, and with five white spots near the tip of each fore wing. The under side of the fore wings is marked something like the upper, but much of the black is replaced by shades of brown. The hind wings are beautifully variegated beneath with greys and browns, and have a row of eye-like spots near the hind margin.

The eggs of this butterfly are laid singly on various species of thistles, particularly the common field thistle (*Cnicus arvensis*), generally in the month of June.

The caterpillar, which is black above and red beneath, with yellowish stripes along the back and sides, feeds under the cover of a silken web which it constructs among the leaves. It is full grown in July or August, when it suspends itself after the manner of the other Vanessas previous to undergoing its changes.

The chrysalis is angular, coloured with brown and grey, and adorned with brilliant gold spots.

The perfect insect may be seen at large throughout late summer and the autumn, and the eggs are laid by females that survive the winter.

The White Admiral (Limenitis Sibylla)

The White Admiral (Plate IV, fig. 5) is neither so pretty nor so common as its red namesake, but it is nevertheless a fine insect, although the chief beauty is reserved for the under surface. Above, the ground colour is a very dark rusty brown, relieved by bands and spots of white. The under surface is beautifully marked with silvery blue, bright orange brown, and white, the latter being arranged just like the corresponding colour on the upper side.

It will be observed that this butterfly does not belong to the *Vanessa* genus; so, while we may look for *family* resemblances, we shall observe a few features in which it differs from the preceding species.

It is not by any means abundant, being unknown in Scotland and Ireland, and confined in England almost exclusively to the oak woods of the south, where its food plant—the honeysuckle (*Lonicera Periclymenum*)—abounds. Here it may be seen during July, gracefully sailing among the trees and across the open spaces.

The caterpillar is very different from those of the Vanessas. Its colour is dark green, with a narrow white stripe along each side. There are very conspicuous branched spines on the third and two following segments, also on the eleventh and twelfth; and smaller spines on most of the others. All the spines are of a brownish colour, with pink tips. While it is yet very small it prepares its winter quarters by bending round the remains of a leaf on which it has been feeding, securing the edges by silken threads, and then binding it to the stem of the plant. Soon after, the petiole becomes detached from the stem, and the little caterpillar then rests suspended in its snug swinging cradle, where it remains perfectly secure till the following April, when the warm sun calls it out to feed on the opening leaves. It continues at this till about the beginning of June, and then changes to a beautiful angular and eared chrysalis, of a bright green colour, marked with brown, and having brilliant silvery spots and streaks.

Family—APATURIDÆ

The Purple Emperor (*Apatura Iris*)

This grand insect is the only British member of its family, and richly deserves its popular title. The male, which is figured on Plate V (fig. 1), exhibits a most gorgeous imperial purple, which is reflected at certain angles only from the upper surface of his large and powerful wings. His flight is lofty and vigorous, and among the topmost branches of majestic oaks, where he defies the efforts of would-be capturers. Unlike our other butterflies, he is also a very quarrelsome creature, and will not hesitate to fiercely attack a brother Emperor who dares approach the branch he has selected for his throne.

Many attempts have been made to capture this prized creature by means of a large net mounted on the end of a pole twenty or thirty feet in length, but the wielding of such a cumbersome implement against so powerful an insect is no mean task, and but few fall a prey to such a snare. But it so happens that this imperial personage has a very depraved appetite, the indulgence in which has often brought him to ruin. Instead of searching out the sweets so bounteously supplied by the blossoms that are so attractive to other lepidopterous insects, he delights in sipping the waters of the filthiest puddles, and imbibing the odoriferous moisture of dung and the decomposing carcases of animals. So deeply seated is this depravity of taste that the Emperor may be netted with ease while indulging in his sumptuous feast, and is even to be taken at times with the fingers.

The knowledge of this peculiarity of the imperial palate has led entomologists to abandon the awkward net, and to bait the woods with viands that alone can entice his highness from his lofty seat; and many a splendid specimen has been easily captured while enjoying the luxurious juice of a dead cat, stoat, or rabbit, or of a seething mass of pig's dung.

The female is larger than her mate, and does not display the beautiful purple reflections that adorn the male. She is very different, too, in her habits, for she sits nearly all day on high branches of trees, giving her attention to the graver duties of an imperial mother, and is consequently but seldom seem. She lays her eggs in July on the sallow (*Salix Caprea*) or the poplar (*Populus*), and in less than a fortnight the young caterpillars are hatched.

They feed on till the leaves are falling, and then fix themselves by their claspers to a silken carpet which they construct on a twig. Here they remain, exposed to all the wintry blasts and frosts, till the new leaves are out in the spring, when they again commence feeding, and continue to do so till they are full grown—in May or June.

The under side of this species is shown in fig. 76, in which will also be observed the eye-like spots of the fore wings which have given rise to its specific name (*Iris*).

The caterpillar (Plate VIII, fig. 5) is a very peculiar creature.

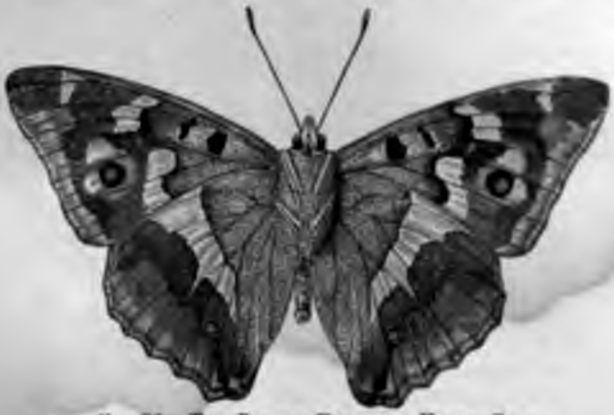


FIG. 76.—THE PURPLE EMPEROR—UNDER SIDE.

Its body is green, with seven oblique yellowish stripes on each side, and it has a pair of horns attached to its head.

The chrysalis (Plate VIII, fig. 10) may be found in June, suspended to the under side of a leaf. It is of an apple-green colour, and still exhibits the oblique stripes which we observed in the caterpillar.

This insect is not to be found in either Scotland or Ireland, but is more or less abundant in many of the oak woods of the midland and southern counties of England. Among the numerous favoured localities, we may mention Colchester, Forest of Dean, Northamptonshire, Ipswich, Huntingdonshire, Buckinghamshire, Epping, Lyndhurst, and the Isle of Wight.

CHAPTER XIV

THE BROWNS AND HEATHS

Family—SATYRIDÆ

THIS family contains eleven British species, often spoken of collectively as the 'Browns,' since in most of them the prevailing tints are various shades of brown. They are decidedly dingy in comparison with the beautiful butterflies we have been previously observing; but to this statement we must allow one marked exception, for the family includes the beautiful Marbled White, which stands out prominently among its fellows for brilliancy and boldness of colour.

The caterpillars of the 'Satyrs' have no spines, but their bodies are covered with very minute hair-bearing warts that give them a soft velvety appearance. The hinder extremity tapers off considerably, and terminates in two points.

The chrysalides are not angular like those of the preceding species, and though generally suspended by the tail, are sometimes found quite free among leaves and grasses on the ground.

The perfect insects are rather feeble fliers, and generally take so little notice of intruders that they are easily caught in the hand. Their wings are devoid of angles, and they have only four perfectly developed legs.

The Marbled White (*Melanargia Galatea*)

Our first member of this family is the exception to which we have already alluded as a relief to the general dinginess of the 'Browns.' Its colours above are cream and black, arranged as shown in Plate V, fig. 2. The under side (fig. 77) is marked with white, black, and greenish grey, with a row of eye-like spots parallel with the hind margin of the hind wings.

This butterfly is not known in Scotland or Ireland, nor is it to be found in several of the northern counties of England. Its chief haunts are the waste cliffy grounds of the southern and some of the midland counties of England, where it is usually restricted to certain small districts. In some places it is really a common insect, and among these may be mentioned Brighton, Horsham, Dover, Folkestone, Margate, Gravesend, New Forest, parts of Gloucestershire, Cambridgeshire, and Devonshire, also in the Isle of Wight and South Wales.

The perfect insect is out in July, during which month the eggs are deposited on various grasses, or indiscriminately on leaves and stems in grassy spots.

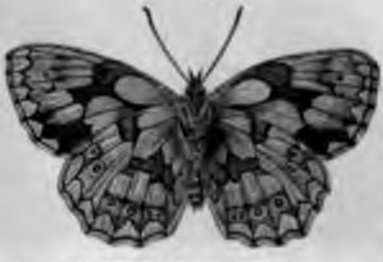


Fig. 77.—The Marbled White—Under Side.

The caterpillar feeds on grasses; and, being still small at the end of the autumn, hybernates during the winter among the stems of grass. It feeds again in April, and is fully grown by the end of May. Its colour is a dull green or brownish, with a darker stripe down the back, and lighter stripes along the sides. Its spiracles are black.

The chrysalis is pale brown, marked with lines of a slightly darker shade. It may be found among grass stems, without any attachment, during the month of June.

The Small Ringlet (*Erebia Epiphron*)

On account of the very limited range of this butterfly, only those who have the opportunity of visiting its haunts can have any practical acquaintance with its natural history. It is almost exclusively confined to the lake district in England, to a few mountainous localities in Scotland, and to one or two similar localities in Ireland. Its strong partiality for elevated situations has earned for it the popular name of Mountain Ringlet.

The colour of the upper surface (Plate V, fig. 3) is a dark brown, with a broad band of rusty brown, parallel with the hind margin of each wing, and broken by the wing rays. Each division of these bands has often a black central spot, but frequently these are entirely absent. The colouring of the under side is very similar but less defined, and the rusty spots of the hind wings are very small.

The butterfly is out in June and July. The caterpillars, which are green, with white stripes along the sides, feed on various grasses. They hybernate during the winter, and change to the chrysalis state in the following May or June.

The Northern Brown (*Erebia Æthiops*)

The colour of this species (Plate V, fig. 4) is a rich dark brown, with rust-coloured and black spotted bands arranged something like those of the last. The markings, however, are very variable. There are usually four black spots on the band of the fore wings, but the first two of these are always united, and centred with white. The third is often very small or entirely wanting.

The under side of the fore wings is marked something like the upper, but the hind wings on this side are grey, with two broad bands of a darker colour.

As its popular name implies, this butterfly is a northerner. It is common in Scotland, where it flies in elevated spots. In England it is confined to the mountainous districts of the north.

The perfect insect is at large in July and August, during which time the eggs are deposited on various grasses or on low-growing herbage in grassy spots.

The caterpillar is of a brown colour, and has a narrow black stripe down the middle of the back, and two other stripes, lighter than the ground colour, one on each side. At about the end of June it turns to a chrysalis of a brownish colour.

The food plants of this species include a number of common grasses.

The Speckled Wood or Wood Argus (*Pararge Egeria*)

Most of our butterflies delight in the hot sun, and are to be seen on the wing only when it is shining brightly. This fact is particularly noticeable on a bright day with occasional heavy clouds. While the sun's rays are pouring uninterruptedly on the landscape, numbers of these light-lovers are to be observed flitting about; but when the dense shadow of a passing cloud creeps over the ground they rapidly disappear from view, having settled down to rest on leaves and stems. Then, as soon as the shadow passes away, the air is again enlivened with their sports and flittings.

The Wood Argus is a marked exception to this rule. It delights in the cool shade of the narrow paths of woods, where it slowly flies up and down the lonely footpath, taking but little heed of strangers that intrude on its haunts, and seldom venturing into the full blaze of the sun unless pursued. Even on dull days it continues its solitary flight, and may even be seen on the wing while a soft rain is bathing the dripping foliage.

The upper surface of this pretty butterfly is shown on Plate V. fig. 5, and the under side in the accompanying woodcut. Both sides are prettily marked with various shades of brown and buff, and adorned with white-centred dark eyespots which have earned for it the name of Argus.

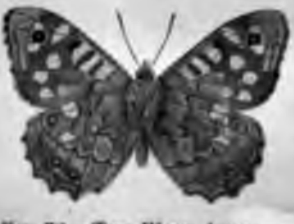


FIG. 78.—THE WOOD ARGUS—UNDER SIDE.

It first appears on the wing in April, and may be seen from this month continuously to the end of August.

The food plants probably consist of many species of grasses, the cock's-foot (*Dactylis glomerata*) and couch grass (*Agropyron repens*) being among the number, and the eggs are laid on or in the neighbourhood of these during the summer months.

The caterpillar of this species is of a dull greenish or brownish colour, and it has two whitish stripes (sometimes three) down the middle of the back, and similar stripes along each side. It hybernates during the winter, and is full grown in March, when it changes to a dull green or brownish chrysalis, which is streaked with black, and has a few white dots on the back.

It has been stated that the butterfly is on the wing from April to August, and, according to some authorities, there are no less than three broods during this time, following each other in rapid succession. It is common throughout England and Ireland, and is known in parts of Scotland.

The Wall Butterfly (*Pararge Megæra*)

Belonging to the same genus is another very familiar butterfly—the Wall—which receives its popular title from its peculiar habit of frequently resting on walls and stony banks. It is one of the first, if not *the* first, to take to the wing in the morning, and is generally the last to seek its hiding place in the evening. I have seen it actively flying about during August, as early as 7.30 in the morning, and found it still flitting from one spot to another along the western side of a wall as late as 8 in the evening, as if in search of a convenient shelter for the fast approaching night.

This pretty 'Brown' must be familiar to the reader, and the coloured drawing on Plate V (fig. 6) will at once serve for purposes of identification without the necessity of a wordy description. It may be mentioned, however, that the male (the sex figured) is smaller than the female, and is further distinguished by a broad dark oblique band passing across each fore wing.

The Wall is a double-brooded butterfly, the first brood appearing in May, and the second in August. The caterpillars which produce the latter may be found on the cock's foot (*Dactylis glomerata*) and other grasses in June, while those of the former are hybernators; and the chrysalides of the two broods may be found in April and July respectively.

The colour of the caterpillar is green, with a slightly darker stripe down the middle of the back, a pale stripe along each side, and another similar stripe about midway between these two.

The chrysalis is green with the exception of the more prominent parts of its surface, which are almost white.

This species is very common in almost every locality in Britain.

The Grayling (*Satyrus Semele*)

The Grayling is the largest of our 'Browns,' and, although a powerful flier, it seldom takes long flights. The female, which is shown in fig. 7, Plate V, is really a beautiful creature, the light markings of which stand out in bold contrast with the deep brown ground colour; but the male is comparatively dingy, there being much less contrast between the ground and the markings. He is also smaller than his mate.

The under side of both sexes is similar (fig. 79), the pattern of the fore wings being much like that of the other side, but considerably lighter, and the hind wings are beautifully marbled with various greys and browns.

This species is not nearly so common as the two preceding, but it is very widely distributed, and is exceedingly abundant in some parts. On some of the heathery cliffs and downs of the south and south-west coasts it is so plentiful that the butterflies are started into the air at almost every step, for it seldom flies except when disturbed. It is a common insect in Ireland, and also in parts of Scotland.

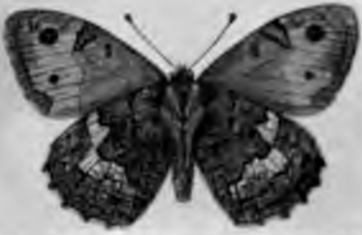


FIG. 79.—THE GRAYLING—UNDER SIDE.

The caterpillar is a hybernator, and may be found feeding on grasses in the autumn and the spring. It changes to the chrysalis in June, and the perfect insect is on the wing from June to the beginning of September.

The colour of the caterpillar is pinkish drab above, and greenish drab beneath. A dark brown stripe, edged with a lighter colour, passes down the middle of the back, and a dark line on each side. It changes to a dark reddish-brown chrysalis on the surface of the ground, or, according to some observers, a little beneath the surface.

The Meadow Brown (Epinephele Janira)

Although this very common butterfly is usually considered to be the dingiest of its family, yet it must be admitted that the colour of a freshly emerged specimen is really very rich.

The male is of a dark brown colour, with an indistinct patch of a lighter tawny brown near the outer margin of the fore wings, and a white-centred black eye-spot near the costal angle of the same wings. The female (Plate V. fig. 8) is of a lighter colour, the eye-spot on her fore wings is larger and far more conspicuous, and an irregular patch of light orange brown occupies a large area of each of the same wings. She is, moreover, larger than her mate, and in every way a more attractive insect.

The Meadow Brown abounds everywhere, from June to September, and may be seen on grass land and waste grounds where other butterflies are seldom found.

The caterpillar is green, and is rendered slightly rough by a number of minute warts. There is also a white stripe on each side. It feeds on various grasses in the autumn, hybernates during the winter, and is full grown in May.

The chrysalis is apple green, spotted with a lighter green, and has several black markings.

The Large Heath (Epinephele Tithonus)

This butterfly is sometimes called the 'Small Meadow Brown,' and is certainly much like the last species, both in colouring and habits.

The fore wings of the male (Plate V, fig. 9) are light orange brown, bordered with dark brown, and having a broad patch of the same across the middle; and near the costal angle is a round black spot with two white dots. The hind wings are dark brown with a patch of light orange brown near the centre, and a small eye-spot near the anal angle. The female is exactly similar, except that she does not possess the broad bar on the fore wings.

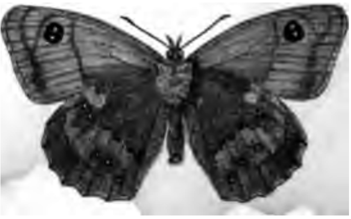


FIG. 80.—THE LARGE HEATH—UNDER SIDE.

The under side is shown in fig. 80, and is coloured with various shades of brown.

This is a very common butterfly, and may be seen during July in most English counties, also in the south of Scotland, and in a few localities in the south of Ireland. It frequents meadows, heaths, downs, and lanes, like *Janira*, but is not nearly so abundant as that species.

The young caterpillar is hatched in August, and is still very small when it seeks its winter shelter among the stems of grasses. It resumes feeding in the following May, and is full grown towards the end of June. Its colour is very variable – pale green, olive green, or dull brown, with five longitudinal stripes at about equal distances from each other. These consist of a dark one down the middle of the back, a pale line along each side, and another pale line midway between these.

The chrysalis may be found at the end of June, attached by the tail to blades of grass. It is of a very light colour, almost white, but adorned with numerous black lines and patches.

The Ringlet (Epinephele Hyperanthus)

This is another rather plainly dressed insect, though somewhat prettily adorned on the under side. The upper surface is of a very deep sepia brown, almost black, with a few indistinct black eye-like spots near the margins. The under side (Plate V, fig. 10) is of a lighter umber brown, with corresponding eye-spots generally very conspicuous. These spots are black, with white centres, and generally surrounded by light rings. They are subject, however, to considerable variation. Those on the upper surface are sometimes quite absent in the male, but are nearly always readily perceptible in the female. On the under side, too, they are occasionally quite absent, while in other varieties they are minute white-centred dots, without any surrounding light ring. Our coloured drawing represents the most usual form.

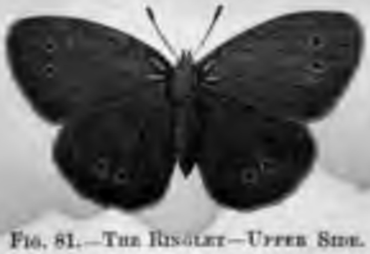


Fig. 81.—The Ringlet—Upper Side.

The favourite haunts of the Ringlet are the borders of woods, and the sheltered sides of flowery hedgerows. It is not so widely distributed as some of the common 'Browns,' but is usually very abundant where it occurs, sometimes appearing in such numbers that several may be taken with a single stroke of the net. It does not seem to be a frequenter of Scotland, and is known in Ireland only in the south. Its head quarters are the southern and south-midland counties of England.

The eggs are laid in July on various grasses, on which the young caterpillars feed from about the middle of August till the cold weather sets in. They hybernate at the roots of the grasses till the beginning of the following May, and change to the chrysalis state about the middle of June, suspending themselves to grass blades by means of their anal hooks.

The colour of the caterpillar is dull green or brown, and is marked with five longitudinal stripes much like those of the Large Heath.

The chrysalis is pale brown, spotted and striped with a darker hade of the same colour.

The Marsh Ringlet (*Cænonympha Typhon*)

The upper surface of this butterfly is shown in the first figure of Plate VI, and the under side in the accompanying woodcut; but it must be remembered that the species is a very variable one, so much so that it is almost impossible to give anything like a short and, at the same time, a satisfactory description. The female may usually be distinguished by a pale patch across the middle of the fore wings; and the eye spots of the same wings, always more or less indistinct when present, are sometimes entirely wanting. The markings of the under side are even more variable, the transverse bars and the eye spots being often particularly conspicuous, and at other times hardly discernible.

This is generally spoken of as a northerner, its chief localities being in the mountainous parts of Scotland and the elevated districts of the north of England, but in Ireland it extends to the southern ranges. Its haunts are elevated moors and marshy heaths, where its food plant—the beak-rush (*Rhyncospora alba*)—abounds, and it is on the wing from the end of June to August or September.

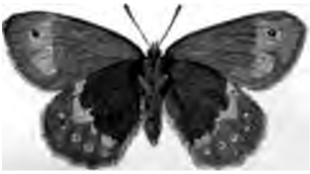


FIG. 82.—THE MARSH RINGLET—UNDER SIDE.

The caterpillar is green, with five longitudinal stripes—one dark one, bordered with yellow, down the middle of the back, and two pale yellow ones on each side. It is a hybernator, and is full grown about the end of May, when it suspends itself by the hindmost claspers to a silken carpet, and changes to a green chrysalis with pale brown wing cases.

The Small Heath (*Cænonympha Pamphilus*)

The last member of the family *Satyridæ* is the well-known Small Heath, that may be seen almost all over the British Isles on heaths, meadows and moors, from May to September.

The upper surface of this butterfly (Plate VI, fig. 2) is a tawny yellow, with a dark brown border, and a spot of the same dark tint near the tip of each fore wing. The under side is much like that of the last species, but there are no eye spots on the hind wings.

The eggs of the first brood are laid during May and June on the various grasses on which the caterpillar feeds.

The caterpillars that emerge from these are fully grown in July or early August, and go through their changes during the latter month ; but the later ones hybernate during the winter, and are not full fed till the following May.

The colour of the larva is pale apple green, with a wide darker stripe down the back, two others along the sides, and two more between the latter and the dorsal stripe. All these five stripes are bordered with a whitish colour.

The chrysalis is bright apple green, dotted with white, and the wing cases are striped with a purple-brown line edged with white.

CHAPTER XV

THE HAIRSTREAKS, COPPERS AND BLUES

Family—LYCÆNIDÆ

THIS is a large family, including as it does no less than nineteen of the British species. These are all of small size, and are characterised by their short and jerky flights. They seldom rise much above the ground, and are consequently very easily caught.

The caterpillars of this family have all short and rather thick bodies, shaped very much like that of the wood louse—flattened beneath and very convex above.

The chrysalides are generally attached by the 'tail,' and further secured by a silken cord round the body, as we have already observed in the case of the *Pieridæ*.

The perfect insects differ from the preceding species in that all six legs are perfectly developed and adapted for walking.

There are only three genera in this large family:

1. *Thecla*—The Hairstreaks, with 'tailed' wings.
2. *Polyommatus*—The 'Coppers.'
3. *Lycæna*—The 'Blues,' with wings either blue or brown.

The Brown Hairstreak (*Thecla Betulæ*)

The five Hairstreaks which constitute the genus *Thecla* are all pretty insects, characterised by hair-like streaks on the under surface.

Betulæ is the largest of these. Its upper surface is of a deep brown colour, with orange-brown marks at the anal angles of the hind wings, and, in the female, a large patch of orange on the fore wings. The under side (Plate VI, fig. 3) is orange brown, much lighter in the male than in the female. On the fore wings are two white lines, the inner one of which is indistinct; and on the hind wings are two others, the outer one being longer and more distinct than the inner.

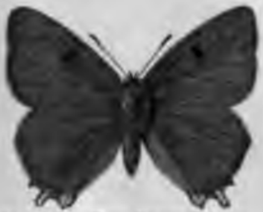


FIG. 83.—THE BROWN HAIRSTREAK—MALE.

This butterfly is by no means an abundant insect, though it is widely distributed, and in some places plentiful. Its chief haunts are woods, and we may mention among its favoured localities Epping Forest, Monk's Wood in Cambridgeshire, the wooded parts of South Devon and Dorset, New Forest, Colchester, and Peterborough.

The perfect insect is on the wing from July to October, and the eggs are deposited in the autumn on the twigs of its food plant—the blackthorn (*Prunus spinosa*). These do not hatch till the following spring. Toward the end of June the caterpillar is fully fed.

The colour of the caterpillar is light green, with two white stripes down the back, and two others along the sides. There are also two small oblique whitish lines on each side of each segment.

The chrysalis is smooth, and of a pale brown colour.

The Black Hairstreak, or White-letter Hairstreak (*Thecla W-album*)

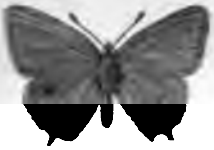


FIG. 84.—THE WHITE-LETTER HAIRSTREAK.

The first of the above two popular names has been applied to this species on account of the very deep brown colour of the upper side, which colour is often a near approach to black. The second is due to the W-shaped bend of the white streak of the hind wings. The ground colour of the under side (Plate VI, fig. 4) is greyish brown, with a bright orange band, spotted with black near the hind margin of the hind wings.

W-album is a somewhat rare insect, but is occasionally seen in plenty in a few localities, Cambridgeshire, Berkshire, Epping, Colchester and Suffolk being among its chief resorts. It is out on the wing in July, and should be looked for in wooded country where the common elm (*Ulmus campestris*) and the wych elm (*U. montana*), its food plants, exist.

The eggs are laid on the twigs of these trees late in the summer, and the young caterpillars do not appear till the following spring. The chrysalis may be found attached to an elm twig or leaf about the end of June.

The caterpillar is pale green. The ridges along the back are tinged with yellow, and there are two fine oblique white lines on each side of each segment.

The Dark Hairstreak (*Thecla Pruni*)

The upper side of this butterfly is very much like that of *W-album*, but it may be distinguished by the presence of a few orange spots near the anal angle of the hind wings. The colouring of the under side (Plate VI, fig. 5) is also very similar, except that the white lines of the wings are thinner and less distinct than in the last species, and do not exhibit the W-shaped bend. The orange band of this surface is bordered on each side with a row of black spots, each of which is touched with a bluish white or a metallic blue.

This insect is not by any means common, but has been seen in considerable numbers in certain localities. It is not found in either Scotland or Ireland, and its chief haunts in England seem to be in Huntingdonshire, Cambridgeshire and Northamptonshire. It frequents wooded country, and flies during June and July.

The eggs are laid late in the summer on the twigs of the blackthorn (*Prunus spinosa*), and are not hatched till the following spring.

The caterpillar, which is pale green, with rows of yellow spots, may be found in May.

The Purple Hairstreak (*Thecla Quercus*)

This pretty butterfly, by far the commonest of the Hairstreaks, though comparatively very small, reminds one forcibly of the noble Purple Emperor. Its haunts are the same oak woods, and its upper surface, though only a dull dark brown in certain lights, exhibits the same imperial purple reflections when viewed at certain angles. The purple of the male extends over the whole of the wings, but that of the female is confined to a V-shaped patch at the base of the fore wings. In the latter case, however, the purple is much richer than in the male sex.

The under side (Plate VI, fig. 6) is coloured with a delicate grey ground, adorned with a white streak on each wing, and a couple of orange spots near the anal angle of the hind wings.

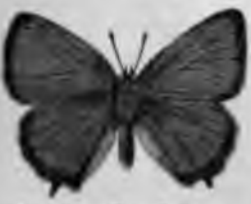


FIG. 85.—THE PURPLE HAIRSTREAK—MALE.

This species is very widely distributed, being common in oak woods in most parts of England, and also in many parts of Scotland and Ireland. It flies around the branches of the trees, and often disappoints the collector by keeping far beyond the reach of his net.

Those in search of this pretty insect should ramble in oak woods, preferably in the south of England, during July and August. The eggs may be found glued to the twigs throughout the winter, and the larvæ may be beaten from the branches of the oak in June.

The colour of the caterpillar is brownish or pinkish green, with a row of V-shaped marks down the back.

The chrysalis is of a brown colour, short and thick, and may be found either attached to oak leaves, or under the surface of the earth at the foot of the tree on which the caterpillar fed.

The Green Hairstreak (*Thecla Rubi*)

Next to *Quercus*, this is the most plentiful of the genus. It frequents woods and heaths in nearly every county in England, and is also found in parts of Scotland and Ireland. It is peculiar among British butterflies as being the only one that exhibits a bright green colour. It also differs from the other Hairstreaks in two important particulars, for the hind wings, though angled at the hind margin, are not 'tailed,' and the characteristic hairstreak which gives the popular name to the genus is here represented only by a series of white dots across the wings, or, in some cases, by one or two dots on the hind wings only.

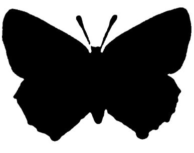


FIG. 86. THE GREEN HAIRSTREAK.

The upper side is dark brown, displaying metallic reflections when viewed in a strong light. The under side is represented in fig. 7 of Plate VI.

The chief food plants of this species are the bramble (*Rubus fruticosus*), the birch (*Betula alba*), and the broom (*Cytisus scoparius*).

The perfect insect flies in May and June, and the eggs are deposited during the latter month on the above plants. The caterpillars are full fed in July, and change to the chrysalis state towards the end of the summer.

The colour of the caterpillar is pale green, with a yellow stripe and several white oblique lines along the sides, also a yellowish stripe down the back.

The chrysalis is short and thick, and of a dark brown colour.

The Large Copper (*Polyommatus Dispar*)

Our next genus contains only two British species. The first of these—the Large Copper—was once a common insect at Whittlesea in Cambridgeshire, and in some of the fens of Huntingdonshire, but is now feared to be quite extinct, as none have been seen for many years. The last capture was made in 1847 in Huntingdonshire. However, it *may* turn up again; and even if it does not, it would be a pity to allow the memory of so fine an insect to die out; so we find room to figure it (Plate VI, fig. 8), and append a few remarks.

There is a very great difference between the male and the female. The former is of a brilliant copper hue, and all the wings have a black margin and a black streak near the middle. The female is larger, and the coppery colour is much redder. The black border of the fore wings is wider, and there are also several large black spots on these wings. The hind wings are almost entirely covered with black, with the exception of a broad coppery band near the hind margin.

The food plant of the caterpillar appears to have been the water dock (*Rumex Hydrolapathum*), on which the eggs were laid late in the summer. It is probable that the caterpillar was a hybernator, seeking its winter shelter while still very young; and it was full fed in June.

Its colour was green, with a darker stripe of the same colour on the back; and the chrysalis was attached by anal hooks and a cord round the body.

The Small Copper (Polyommatus Phlæas)

The only other British member of the genus *Polyommatus*—the Small Copper—is one of the commonest of our butterflies. It may be found in nearly all parts of the British Isles from April to September, more particularly in April, June, and August, for it is apparently triple brooded.

This brilliant and lively little insect is shown on Plate VI (fig. 9), and, being so very familiar, needs no description.

The caterpillar feeds on different species of dock—the broad-leaved dock (*Rumex obtusifolius*), the fiddle dock (*R. pulcher*), the sorrel (*R. acetosa*), and the sheep sorrel (*R. acetosella*); also on the ragwort (*Senecio Jacobæa*). It is full fed about three weeks after hatching, and then changes to a small and stout chrysalis, of a pale brown colour, on the leaf of its food plant.

The caterpillar itself is green, with a reddish line on the back and on each side; and it glides over the surface of the leaves something after the manner of a slug, without exhibiting any very apparent motion of its short legs and claspers.

The Tailed Blue (Lycæna Bætica)

We now come to a genus containing no less than ten species of beautiful little butterflies, known commonly as the 'Blues;' but one of them exhibits no trace of the colour so characteristic of the group, although it resembles the others in structure and habits.

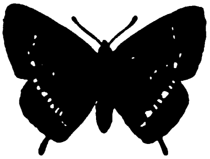


Fig. 87.—The Tailed Blue. Under Side.

Our first example is the Tailed Blue, known also as the Pea-pod Argus. The upper side of this insect (Plate VI, fig. 10) is of a dull smoke colour, exhibiting purple-blue reflections, which are, in the female, confined to distinct blotches on the bases of the wings, but in the male are less noticeable, and extend over the whole surface. The hind margin of the hind wings has a row of spots, more or less distinct, and much more prominent in the female than in the male. The under side is beautifully marked with bands of fawn and grey, and with two spots of brilliant metallic green in the anal angle of the hind wings.

This butterfly abounds in the countries of South Europe, where the caterpillar feeds on the pods of certain leguminous plants; but only a few stragglers have been taken in England, so that its reputation as a true Britisher is very uncertain. It is highly probable that the two or three specimens caught on our south coast were blown over from the Continent, and that the insect has never bred on this side of the Channel.

The Silver-studded Blue (*Lycæna Ægon*)

The upper surface of the male (Plate VI, fig. 11) of this species is purple blue, with a black border on the hind margins of all wings. The female (fig. 12 of the same plate) is of a very dark smoky-brown colour, often with a bluish tinge, and has generally a row of orange spots near the hind margin of the hind wings.

The under side of both sexes is similar, and is illustrated in the accompanying woodcut. The ground colour is bluish grey, and is marked with a number of black spots surrounded by light rings. Along the hind margin of the hind wings is a row of orange spots, each bordered with black on the inner side, and with a silvery blue on the outer.

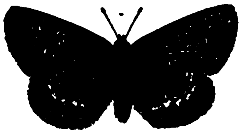


FIG. 88.
THE SILVER-STUDDED BLUE—UNDER SIDE.

This insect appears in July, and is common in many dry, sandy, or chalky spots in various parts of England, and also in a few localities in Scotland and Ireland. It has been reported as abundant at Darlington and in certain localities in Lancashire, but its head quarters are undoubtedly the chalk downs and dry gravelly banks of the southern counties.

The caterpillar feeds on the bird's-foot (*Ornithopus perpusillus*), and is full grown towards the end of June. Its colour is yellow or grey, with a brown dorsal stripe, a white line on each side, and pale oblique lines near the former. About the end of June it changes to a dull green chrysalis, with projecting wing cases.

The Brown Argus (*Lycæna Astrarche*)

Neither male nor female of this species exhibits any trace of blue. The upper surface, shown in fig. 13 of Plate VI, is coloured with a warm brown, and all four wings have a row of orange spots near the hind margin. The fore wings have also a central black spot. The under surface, drawn on the same plate (fig. 14), is bluish grey, with a border of orange spots on each hind margin as on the other side. There are also numerous black spots in light rings, the arrangement of which will be seen in the figure.

Some species of butterflies and moths are so variable in their colouring and markings that varieties have often been mistaken for distinct species; and, in other cases, distinct species are sometimes so similar in character that they are looked upon as identical.

A butterfly that closely resembles the normal Brown Argus in many points, and named *Artaxerxes*, has often been described as a distinct species, but is now, I believe, recognised by most entomologists as a constant variety of the present species.

It differs from the normal type in having a *white* instead of a *black* spot in the centre of the fore wings, and the border of orange spots is often very indistinct. On the under side, too, instead of black spots in white rings, it has white spots, with little or no trace of a black centre.

The ordinary Brown Argus is a southerner, and is particularly abundant on the chalk downs of the south coast and the Isle of Wight, but *Artaxerxes* is to be found only in Scotland and the north of England; and it is interesting to note that, between these northern and southern districts, intermediate varieties are to be met with.

Again, *Astrarche* is a double-brooded butterfly, appearing on the wing in May and August; while *Artaxerxes* is single brooded, flying at midsummer. This fact has lent support to the opinion that the two are distinct species; but it must be remembered that several insects that are single brooded in one country are double brooded in a warmer climate.

The caterpillar of *Astrarche* feeds on the hemlock stork's-bill (*Erodium cicutarium*). It is of a pale yellow colour, with a brownish line on the back; and is full fed in April and July.

The Common Blue (*Lycæna Icarus*)

Although this pretty little butterfly is so common that it is almost sure to be known to all who take any interest in insect life, yet it is important to observe it carefully, since it is an easy matter to confound it with other species of the same genus.

The upper surfaces of the two sexes are very different, that of the male (Plate VI, fig. 15) being a beautiful lilac blue; and that of the female (Plate VI, fig. 16) a dark brown, powdered with blue at the bases of the wings, and having *generally* a border of orange spots, more or less defined, on the hind margins of all wings.

The under side, shown in the accompanying woodcut, is ashy brown; warm in the female, but paler in the male. The hind wings, and sometimes all four, are bordered with orange spots; and this species may be distinguished from *Astrarche* by the presence of two black spots, in white rings, near the base of the fore wings.

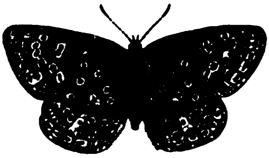


Fig. 89.—The Common Blue—Under Side.

There will be no need to name localities for this insect, as it is abundant everywhere, frequenting meadows, heaths, and all waste places. It is double brooded, and is on the wing continuously from May to September, the first brood enduring from May to July, and the second from July to the end of the warm weather.

The caterpillar is green, with a dorsal line of a darker tint, and a row of white spots on each side. It feeds on clover (*Trifolium pratense* and *T. repens*), bird's-foot (*Ornithopus perpusillus*), bird's-foot trefoil (*Lotus corniculatus*), and the rest-harrow (*Ononis spinosa*).

The chrysalis is short and rounded, of a dull green colour, tinged with brown on the under surface.

The Clifden Blue (*Lycæna Bellargus*)

Our coloured representations of this beautiful blue (Plate VI, figs. 17 and 18) show that here also there is a great difference between the male and female. The former is a most lovely and brilliant sky blue, bordered by a fine black line; and the latter is a dull dark brown, with a more or less distinct border of orange spots, and the bases of the wings are powdered with scales of a tint corresponding with those of the male. In both sexes the fringe is very distinctly barred with dark brown.

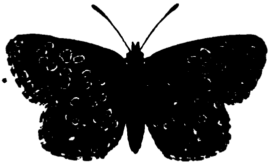


Fig. 90.—The Clifden Blue—Under Side.

The under side (fig. 90) is similar in both sexes—greyish brown, with a border of reddish spots, and a number of black spots in white rings, the arrangement of which is here represented.

The butterfly frequents chalky downs, chiefly in the south of England, and seems to be unknown in Scotland and Ireland. The Isle of Wight, and the chalky downs and banks of Sussex, Surrey, and Kent, are its favourite localities; and even in these it is generally very local, sometimes swarming on a grassy bank of no great extent, when the surrounding neighbourhood, though apparently equally suitable to its requirements, does not harbour a single specimen. It is on the wing in May and June, and again in August.

The caterpillar is green, with two rows of yellow streaks on the back, and a yellow stripe on each side. It feeds on the Dutch clover (*Trifolium repens*), horse-shoe vetch (*Hippocrepis comosa*), and various other leguminous plants.

The Chalk-Hill Blue (*Lycæna Corydon*)

The male of this species (Plate VII, fig. 1) is readily to be distinguished from all other members of the genus by its pale glossy blue, but the female (fig. 2 of Plate VII) so closely resembles that of *Bellargus* that it is often a somewhat difficult matter to discriminate between them. The following, however, are a few points worthy of observation: The upper side of the female *Corydon* has the bases of the wings more or less sprinkled with the pale silky blue that characterises the male; and the black bars of the fringe are *usually* broader in *Corydon* than in *Bellargus*. The black-centred spots of the under side are also usually more conspicuous in the former species than in the latter. The difficulty of identification is increased by the fact that both these butterflies frequent similar localities, and are often on the wing at the same time: but although *Corydon* is certainly a frequenter of chalky districts, yet it is often found plentifully in districts far removed from the chalk, notably at Arnside in Lancashire, and in Epping Forest.

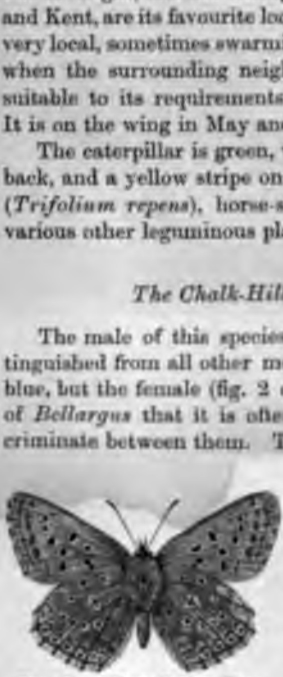


FIG. 91.—THE CHALK HILL BLUE—UNDER SIDE.

The butterfly is out in June and July. The caterpillar is green, with two rows of short yellow streaks on the back, and a yellow stripe on each side. It feeds on the purple and Dutch clovers

(*Trifolium pratense* and *T. repens*), bird's-foot trefoil (*Lotus corniculatus*), horse-shoe vetch (*Hippocrepis comosa*), and lady's fingers (*Anthyllis vulneraria*).

The Holly Blue (*Lycæna Argiolus*)

While all the other Blues delight to sport on low flowery banks in the full blaze of the summer's sun, the Holly Blue prefers to flit among the branches of trees, often many feet from the ground. The larva feeds on the flowers of the holly (*Ilex Aquifolium*) in the spring, and on those of the ivy (*Hedera Helix*) late in the summer; also on the alder buckthorn (*Rhamnus Frangula*); and it is in localities where these grow that we may find this lovely Blue sporting among the branches, or resting on a leaf with its wings folded together, thus making itself conspicuous among the dark foliage by exposing the pale silvery blue of its under surface.

The upper sides of both the male and female are shown on Plate VII (figs. 3 and 4 respectively), where the beautiful lilac blue will be seen to have a border of black, wider in the latter than in the former.

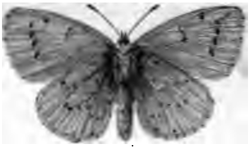


FIG. 92.—THE HOLLY BLUE—UNDER SIDE.

The under surface is spotted with black, as shown in fig. 92, and has no border of orange spots.

This is a double-brooded butterfly, appearing first in April and May, and then again in August. It is not at all uncommon in the south of England, and extends northward as far as the Lake District, but is not found in Scotland. It is generally distributed throughout Ireland.

The caterpillar may be looked for in June and October. It is light green, with a line of dark green down the back.

The Mazarine Blue (*Lycæna Semiargus*)

The male (Plate VII, fig. 5) is deep purple blue, with a narrow dark-brown border, and the female (fig. 6 of the same plate) dark brown. The under side of both sexes is light greyish-brown or drab, with a row of black spots in white rings parallel with the hind margin of each wing, and no reddish or orange spots.

This pretty butterfly seems to have been plentiful in several localities some years since, but has not been seen for a long time; and it is probable that its reckless slaughter by those who catch all the pretty butterflies they can secure either for ornament or for gain has caused its name to be permanently removed from our list of natives.

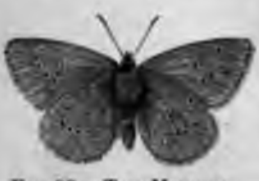


FIG. 93.—THE MAZARINE BLUE—UNDER SIDE.

It was formerly abundant in Dorset, Hereford, Glamorganshire, and near Shirley, and was on the wing in June and July, but it disappeared from our view before a full account of its life history had been prepared.

The Small Blue (Lycæna Minima)

We now come to the smallest of all British butterflies—a little insect that measures less than one inch from tip to tip when its wings are expanded. Its upper surface is of a dull and dark-brown colour, the bases of the wings being dusted with blue in the case of the male. The under side is pale drab, tinged with greenish blue at the bases of the wings, and marked with black spots in light rings as shown in the accompanying figure. The upper side is represented in fig. 7 of Plate VII.

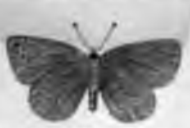


FIG. 94.—THE SMALL BLUE—UNDER SIDE.

This butterfly is on the wing in May and June, and during the latter month the eggs are deposited on the flowers of the lady's fingers (*Anthyllis vulneraria*).

The caterpillars are hatched in about a week, and commence feeding on the calyx of the buds, and soon burrow into them till they are quite concealed. The colour of the caterpillar is brownish, with a darker stripe on the back, and a row of oblique brown streaks on each side.

This species is widely distributed in England, and is plentiful in most chalky and limestone districts. It is also found in parts of Scotland and Ireland.

The Large Blue (Lycæna Arion)

The last of our Blues is the largest of the genus, and is, with the exception of *Semiargus*, the rarest. It is a very local insect, appearing in small numbers, during June and July, in parts of South Devon, Gloucestershire, Northamptonshire, and a few other counties.

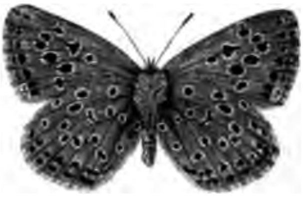


FIG. 95.—THE LARGE BLUE—UNDER SIDE.

The colour of the upper side is a dark and rich blue, with a broad dark border on the hind margins, and a group of black spots near the centre of the fore wings. The under side (fig. 95) is of a pearly grey, without any red spots, but having a double border of black spots, and also an irregular row of black spots in white rings across the middle of each wing.

The caterpillar feeds on thyme (*Thymus Serpyllum*), on which plant the eggs are laid singly, generally on the flower heads.

CHAPTER XVI

THE DUKE OF BURGUNDY AND THE SKIPPERS

Family—ERYCINIDÆ

The Duke of Burgundy (Nemeobius Lucina)

THE family *Erycinidæ* has only one British representative, commonly known as the Duke of Burgundy Fritillary, but although this butterfly certainly resembles the Fritillaries in general appearance (see figs. 9 and 10 of Plate VII), its habits and life history present many points of difference from these.

The upper side is chequered with black and tawny brown, the fringe is white and barred with dark brown, and a row of tawny spots with black centres border the hind margins. The under side has two rows of white spots, one near the base, and the other across the centre of each wing.

The male has only four legs adapted for walking, but the female has six.

The butterfly is out in May and June, and frequents the paths and open spaces of woods, chiefly in the south of England, but it has been taken in some of the northern counties.

The caterpillar (Plate VIII, fig. 6) is not spiny like those of the true Fritillaries, but more closely resembles those of the Blues, being somewhat of the form of a woodlouse. It is reddish brown, with tufts of hair, black spiracles, and a dark line down the back. It feeds on the primrose (*Primula acaulis*) and the cowslip (*P. veris*), and may be found during June, July and August.

When fully grown, the caterpillar secures itself to a leaf or stem by means of its anal claspers and a silken cord round its body, and changes to a short, thick, hairy and light-coloured chrysalis (Plate VIII, fig. 11), which is marked with several black spots. In this state it spends the winter, and emerges early in the following summer.

Family--Hesperiidæ—The Skippers

This family contains eight small species, none of which are remarkable for brilliancy of colour. They are, nevertheless, very interesting creatures, for they exhibit peculiarities of structure and habit that render them singular among the butterflies, and seem to show a sort of cousin relationship with the moths. They have thick bodies that remind us somewhat of the *Noctuæ.* Their heads are broad, so that the antennæ, which are slightly hooked at the tips, are rather wide apart at the bases. When at rest, they neither press their wings together over their back like the other butterflies, nor do they set them horizontally after the manner of the moths, but seem to lay claim to an intermediate position in the scale of Lepidopterous insects by holding them in a half-elevated position. Their flight, too, is not graceful like that of most other butterflies, nor even so steady as that of the little flitting blues, but brisk and erratic, and resembling the fitful motions of moths disturbed from their slumberings at unwonted hours. Thus they have earned their popular title of skippers from their habit of skipping rather than flying from flower to flower. All the three pairs of legs of these butterflies are fully developed for walking.

The caterpillars have rather large heads, and their bodies taper from the middle toward both extremities. Like the larvæ of many moths, they hide themselves in leaves which they have rolled and secured with silken threads; and when about to change to the chrysalis state, they also spin silken cocoons for their further protection.

The Grizzled Skipper (*Syrichthus Malvæ*)

The ground colour of this species is a very dark brown, relieved by a number of squarish white spots arranged as shown in fig. 11 of Plate VII. The fringe is wide, and barred with the same two colours, arranged alternately. The pattern of the under side is similar, but the dark brown of the upper surface is replaced by a lighter olive tint.

The butterfly may be looked for in May in the open spaces of woods, particularly in damp places. It is common all over England, and is found also in the south of Scotland.

The caterpillar is either green or brownish, with a darker dorsal stripe of the same colour, and two white lines on each side. It feeds on the raspberry (*Rubus idæus*), the bramble (*R. fruticosus*), and the strawberry-leaved cinquefoil (*Potentilla Fragariastrum*), and is full fed about the end of June.

The chrysalis is greyish, spotted with black. It is rather elongated, and without angles, but has a short and sharp projection extending backwards from the 'tail.'

The Dingy Skipper (*Nisoniades Tages*)

Colour—a dingy brown, indistinctly barred and spotted with a darker tint, and having a row of small white spots just inside the fringe of the hind margins. Under side—a paler brown, with rows of small white spots.

This butterfly is common in all parts of England, and is found in a few localities in Scotland and Ireland. It frequents dry banks, and is particularly partial to the chalky districts of the south-eastern counties. It is on the wing in May, and a second brood appears in lesser numbers in August.

The caterpillar is pale green, with two yellow stripes on each side, and a row of black spots above each stripe. It feeds on the bird's-foot trefoil (*Lotus corniculatus*), and may be found in June, and again in September.

The chrysalis (Plate VIII, fig. 12) is shaped something like that of the last species, and is coloured green on the front segments, and a rose red on the abdomen.

The perfect insect is represented in fig. 12 of Plate VII.

The Small Skipper (*Hesperia Thaumas*)

In briefly describing the various British butterflies no mention has been made, except in a few cases, of the shape of the wings, this matter having been left to the reader's own observations of our illustrations. We will, however, call attention to the somewhat square-cut form of the wings of *Thaumas* and the following species.

The above-named butterfly (Plate VII, fig. 13) is a lively-looking little insect, its wings being of a bright tawny orange colour, bordered with black, beyond which is a light fringe. The male, which is the sex figured, is distinguished from the female by an oblique black streak across the middle of the front wings. The under side is orange, with a decidedly greenish tinge.

The butterfly is out in July, and is very abundant and widely distributed. It lays its eggs on various grasses, particularly the meadow soft-grass (*Holcus lanatus*).

The caterpillar hybernates through the winter, and is full fed in the following June, when it changes to a green chrysalis after spinning a light silken cocoon among the blades of grass. The colour of the caterpillar is green, with six longitudinal white stripes—two on the back, and two on each side.

The New Small Skipper (*Hesperia Lineola*)

A few years since (1888) a butterfly was taken in one of our south-eastern counties that closely resembled the well-known *Thaumas* (or *Linea*), but which turned out to be a species not previously known in Britain. When, however, the distinguishing features of the new butterfly were made known, several entomologists discovered that they had already secured the new prize, but that, being ignorant of its characteristics, they had placed it in their series over the label *Thaumas*.

Since the above date, this new insect (Plate VII, fig. 18), which is named *Lineola*, has been taken in considerable numbers at Leigh, Harwich, Southend, and near Shoeburyness in Suffolk, as well as in the Fens of Huntingdonshire; and it is highly probable that it may turn up in various other localities where it has not yet been observed.

It appears on the wing about the first week of July, a little later than *Thaumas*, but the two kindred species are often found flying together.

The chief points by which we distinguish Lineola from the last species are these: The general appearance of the wings is a bit dingier than in *Thaumas*; the inner portion of the hind wings is of a bright tawny colour in *Thaumas* but not in *Lineola*; the tips of the antennæ are yellow beneath in *Thaumas*, but black in *Lineola*; and the black streak across the fore wings of the latter species is short and generally broken.

The eggs of *Lineola* are laid at the end of July or beginning of August on various grasses, chiefly the various species of *Triticum*, but do not hatch till the following April.

The larva is full fed about the end of June or beginning of July, and then changes to a long yellowish-green chrysalis, from which the perfect insect emerges in two or three weeks.

The Lulworth Skipper (*Hesperia Actæon*)

Although this species is somewhat similar to the two preceding, it may be readily distinguished by the heavy clouding of dull greenish brown that almost covers the wings. The male, which is shown in fig. 14 of Plate VII, has a black streak across the fore wings, and the female possesses a semicircular row of tawny spots near the tip of the same wings, and also a tawny streak near the centre.

This is a very local species, having been found only in a few localities. At Lulworth Cove and 'Burning Cliff' in Dorset it has been met with in profusion. In Devon it frequents the rough ground near the cliffs at Sidmouth and Torquay; and it has also been reported as appearing at Stratford-on-Avon, Shenstone near Lichfield, and the neighbourhoods of Swanage and Tyneham.

One can scarcely hope to see this insect at large without making a special trip to one of its favourite haunts, in which case a day should be chosen toward the end of July or early in August.

The Large Skipper (Hesperia Sylvanus)

During May, June, and August this butterfly may be seen on grassy banks in nearly every part of England, as well as in certain localities of Scotland and Ireland.

The wings are all of a bright orange-brown colour, with a narrow black border, inside which is a broad shading of brown. The latter colour usually completely covers the hind wings with the exception of about half a dozen squarish spots; and the same colour, together with the dark brown wing rays, breaks up the light ground of the fore wings, often forming several squarish and triangular patches, most distinct near the tips. The male (Plate VII, fig. 15) may be readily distinguished from the female by the presence of a thick dark brown streak across the fore wings.

The under side of both sexes is pale tawny brown, with a greenish tinge; and has several rather indistinct yellowish spots.

The larva is of a dull green colour, with a dark line on the back. Its upper surface is dotted with black, and there are white spots on the under side of the tenth and eleventh segments. It feeds on several kinds of grasses, some of its favourites being the meadow soft grass (*Holcus lanatus*), the cock's-foot (*Dactylis glomerata*), and couch grass (*Agropyron repens*).

The Silver-spotted Skipper (Hesperia Comma)

This species is very similar on the upper side to the last, except that the squarish spots of both fore and hind wings are much paler and much more distinct; and here, too, the male (Plate VII, fig. 16) is to be distinguished from the female by a black streak crossing the front wings obliquely. The under surface has a greenish tinge, more particularly on the hind wings; and this side is conspicuously marked with a number of *white* square spots with sharp outlines, arranged as shown in fig. 96.

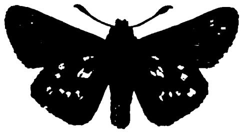


Fig. 96.—The Silver-spotted Skipper—Under Side.

Although common in some localities, this butterfly is not widely distributed. It is confined to some of the southern and midland counties of England, and is particularly partial to the chalk districts of the south-east. On the chalk downs of Kent, Surrey, and Sussex it is moderately common. It is on the wing during July and August.

The caterpillar feeds on certain leguminous plants, among which are the bird's-foot (*Ornithopus perpusillus*) and the bird's-foot trefoil (*Lotus corniculatus*).

The Chequered Skipper (Carterocephalus Palæmon)

This is another local insect, more so even than the last, but it sometimes appears in profusion in certain limited districts. Kettering, Oundle in Northamptonshire, and Monk's Wood in Huntingdonshire are places where it has been taken freely. It appears in June.

The wings are chequered with very dark brown and orange. The fore wings are bordered with small rounded yellow spots, and beside these there are about nine very conspicuous yellow spots on the fore wing and three on the hind wing. The arrangement of these markings may be seen in fig. 17 of Plate VII.

The caterpillar feeds on the greater plantain (*Plantago major*).

PART IV

COMMON BRITISH MOTHS

CHAPTER XVII

SPHINGES

We have already observed the chief features by which we are able to distinguish between butterflies and moths (page 56), so we shall devote the present division to a description of the characteristics and life histories of some of the latter insects.

The number of British butterflies is so limited that space could be found for a brief description of every species, but with moths the case is very different. There are about two thousand known British species of this division of the Lepidoptera, and every year adds some newly discovered insects to this long list; we shall therefore have to content ourselves with making a selection of these for individual mention.

In doing this I shall endeavour to provide the young entomologist with a fairly representative list—one that will enable him to become more or less intimately acquainted with all the principal divisions of the *Heterocera*; and his attention will be drawn especially to many which may be described as 'common' or 'generally distributed,' so that during his first few seasons at collecting he may be enabled to identify and study a fair proportion of his captures. Occasionally, however, one of the rarer species will be described in order to illustrate some striking characteristic.

We shall commence with the tribe of *Sphinges* or *Hawk Moths.*

This group consists of three families—the *Sphingidæ*, including the largest of the 'Hawks,' and the 'Bee Hawks,' the *Sesiidæ* or 'Clearwings,' and the *Zygænidæ*, including the 'Foresters' and the 'Burnets'—numbering in all about forty species.

Family—Sphingidæ

This family is named from a fancied resemblance of the larvæ to the celebrated Egyptian sphinx. The perfect insects have very thick bodies, generally tapering toward the tail, and their wings are rather narrow in proportion to the length, but are exceedingly powerful, and the flight is, with one or two exceptions, very rapid. The antennæ terminate in a small and thin hook.

Most of these insects fly at dusk, but a few delight in the brightness and heat of the midday sun. In either case the velocity of their flight is generally so great that it is a difficult matter to follow them with the eye, and a still more difficult matter to secure the insects in the net; consequently, the best way to study them is to search out the larvæ on their food plants, and rear them till they attain their perfect form.

The larvæ of the *Sphingidæ* are large and smooth, and most of them have a horn projecting from the top of the last segment but one. They all undergo their metamorphoses under the surface of the ground.

The Death's-Head Hawk (Acherontia Atropos)

Our first example of the Sphinges is the beautiful Death's-Head Hawk Moth—an insect that often attains a breadth of five inches from tip to tip when the wings are fully expanded. Its popular title has been applied on account of the peculiar markings of the thorax, which are said to resemble a human skull; and this feature has certainly some connection with the superstitious beliefs of ignorant country folk concerning this moth. But this characteristic is probably not the only one that has caused the creature to be regarded with superstitious alarm. Both its superior dimensions and nocturnal habits serve to intensify the unfounded fear; but, what is particularly striking and unique about it is its power of uttering a squeaking sound, which it does when disturbed. Even the earlier stages of the insect possess this strange power. The caterpillar makes a peculiar snapping noise when irritated, and the chrysalis has been observed to squeak shortly before the emergence of the perfect form.

The fore wings of this moth are of a very rich dark brown, beautifully mottled with lighter tawny shades, and with a small but conspicuous yellow dot near the centre. The hind wings are yellow, with a black band and margin; and the body is yellow, with six broad black bands, and six large blue spots down the middle.

The moth is rather widely distributed, and even common in some parts, but is not nearly so often met with as the larva. It is on the wing during August and September.

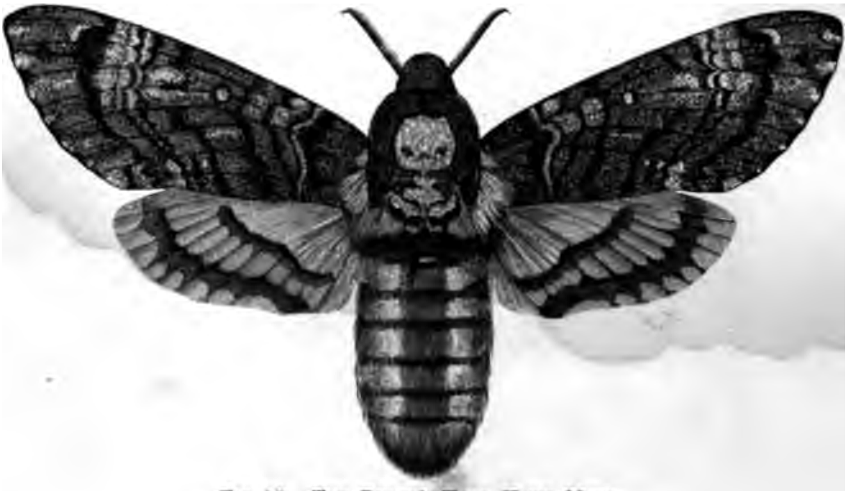


FIG. 97.—THE DEATH'S-HEAD HAWK MOTH.

It is probable that the reader will never have an opportunity of capturing the perfect form of this remarkable species, but he may with a little perseverance obtain some caterpillars and rear them. These larvæ feed on the potato, the deadly nightshade (*Atropa Belladonna*), and the woody nightshade (*Solanum Dulcamara*); and they are well known to potato growers in some parts of the country.

The colour of the caterpillar is generally pale yellow, with numerous small black dots, and seven oblique violet stripes on each side. The horn is yellowish and rough, and is bent downward, but recurved again at the tip.

It feeds during the night, and remains hidden throughout the daytime. In August it is fully grown, and then retires into the ground to undergo its transformations.

The Privet Hawk (Sphinx Ligustri)

This is another fine moth, measuring nearly four and a half inches from tip to tip. It is represented in the centre of Plate IX in its natural colours, so that it need not be described.

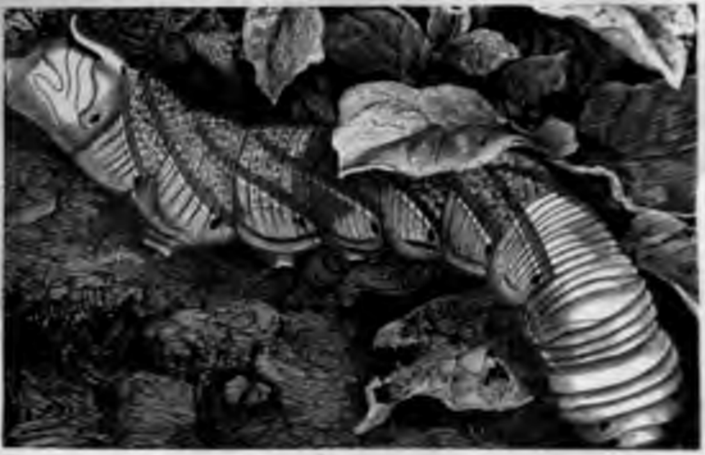


FIG. 98.—THE LARVA OF ATROPOS.

The perfect insect flies in June and July, and, although common, is not frequently seen at large. The larvæ, however, are to be met with in abundance in privet hedges. Even in the centres of large towns we may see them resting on the topmost twigs of a privet hedge, their beautiful green tint closely resembling that of the surrounding leaves. After a little experience they may be readily discerned by a careful observer, but there are certain signs by which their presence may be proved before they have been actually seen. Sometimes a number of the twigs are completely stripped of their leaves, even the midribs and the leaf stalks being almost or entirely devoured; and beneath the bushes are the large black masses of excrement that tell of the marauders above. When found, these larvæ should always be removed on a piece of the twig to which they are attached, for they hold on so firmly by their claspers that it is sometimes almost impossible to remove them from their hold without injury.

These caterpillars may easily be distinguished from those of the other 'hawks' by the seven oblique stripes which adorn the sides. These are each composed of two colours, white and lilac, and form a pretty contrast with the bright green of the rest of the body. The horn is smooth and curved, and is black with the exception of part of the under side, which is yellow.

They are fully grown in August, and from the end of this month till the following June the chrysalides may be dug out from under privet and lilac bushes, both of which are attacked by the larva.

The Spurge Hawk (*Deilephila Euphorbiæ*)

This is a very rare British species; in fact, it has never been seen in this country in its perfect state, but the larva has been found plentifully at Appledore and Braunton Burrows, in North Devon, feeding on the sea spurge (*Euphorbia Paralias*).

The perfect insect is shown on Plate IX (fig. 2).

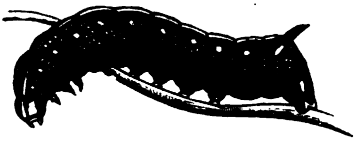


FIG. 99.—THE CATERPILLAR OF EUPHORBIÆ.

The caterpillar is black, with a large number of small yellowish white dots, and two rows of spots of the same colour on each side. There is also a red line on each side, and another down the middle of the back. The horn is rough and red with a black tip. It feeds during August and September.

The Small Elephant Hawk (*Chœrocampa Porcellus*)

This pretty insect is one of the smallest of our hawk moths. It is widely distributed, being met with in many parts of England and in the south of Scotland. It flies in June.

The fore wings are of a dull yellow colour, with rosy-red hind margins, and a broad border of the same tint on the costal margin. The hind wings have also a rosy-red hind margin, and are smoky black along the costæ, and yellow in the anal angle. The body is coloured with bright rose-red, tinged with olive on the foremost and hindmost segments.

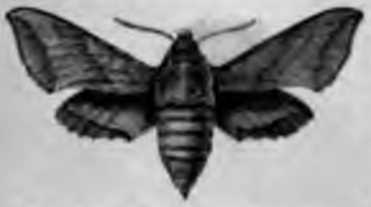


FIG. 100.—THE SMALL ELEPHANT HAWK MOTH.

The popular name of this and the following species has been applied because of the power which the caterpillar has of extending and retracting its front segments, a peculiarity which has given the idea of a semblance to the elephant's proboscis. The colour of the caterpillar is light-brown or green, mottled with dark-brown, dark-green, or black. It has a conspicuous eye-like spot on each side of the fifth and sixth segments, and has no horn.

This larva may be found in July and August, feeding on species of bedstraw (*Galium verum*, *G. Mollugo*, and *G. palustre*), willow herb (*Epilobium hirsutum*), or the purple loosestrife (*Lythrum Salicaria*).

The Large Elephant (*Chærocampa Elpenor*)

This species (Plate IX, fig. 3) is very similar to the last in form and markings; but is, as its name implies, larger.

The caterpillar, too, is very like that of the last species, but may be distinguished from it by the possession of a short black horn, tipped with white, on the 'tail.' Its colour is green or brown, mottled and spotted with black. The eye-like spots on its fifth and sixth segments are black, and each contains a brown spot surrounded by a white line.

Its chief food plants are the hairy willow herb (*Epilobium hirsutum*), three species of bedstraw (*Galium verum*, *G. Mollugo* and *G. palustre*), the purple loosestrife (*Lythrum Salicaria*), and the enchanter's nightshade (*Circæa lutetiana*). It will also feed on the vine and the apple in confinement.

The Eyed Hawk (*Smerinthus Ocellatus*)

Our next genus (*Smerinthus*) contains three well-known moths, all of which have the hind margin of the fore wings angulated or indented.

The first is the Eyed Hawk, represented in fig. 4 of Plate IX and named after the beautiful and conspicuous eye-like spot near the anal angle of each hind wing.

The caterpillar has a rough green skin, sprinkled with white dots, and marked with seven oblique white lines on each side, each of which is bordered with dark green above. The spiracles are pinkish, surrounded by violet rings; and the horn is blue.

The moth flies during May, June, and July; and the caterpillar may be found in plenty during August, feeding on the apple, willow (*Salix alba*), sallow (*S. cinerea* and *S. Caprea*), poplar (*Populus alba* and *P. nigra*), aspen (*P. tremula*), and the blackthorn (*Prunus spinosa*).

As with many other *Sphinges*, the larvæ are much more commonly seen than the perfect insects; but the latter may often be met with resting on tree trunks and fences in the neighbourhood of their food plants.

The Poplar Hawk (Smerinthus Populi)

This moth is very common and very widely distributed, and may be easily found in any of its stages. The perfect insect flies during May, June, and July; and being rather heavy on the wing, it is easily taken with a net as it hovers round the branches of its favourite trees or among the flowers of gardens at dusk. The larva may be beaten from the boughs of poplars and sallows during August and September, and during the latter month may often be seen creeping down and around the trunks of these trees, searching for a suitable spot in which to undergo its changes. The pupa may be dug out

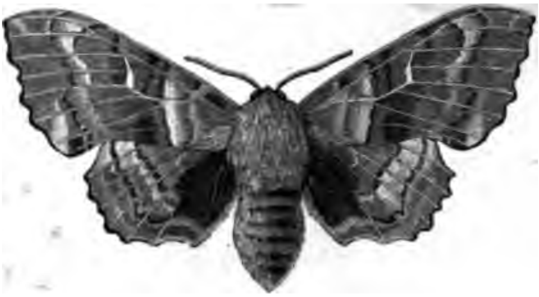


FIG. 101.—THE POPLAR HAWK.

of the soil at the foot of the same trees during the autumn, winter, and spring months.

The fore wings are ashy grey or greyish brown, marbled with darker tints, with a conspicuous white spot near the centre. The hind wings are similarly coloured except at the base, where there is a large patch of brick-red.

The caterpillar is rough, of a pale green colour dotted with yellow, with seven oblique yellow stripes on each side. The spiracles are white, edged with red; and the horn is yellow on the upper, and reddish on the under side. Its chief food plants are the poplar, the Lombardy poplar (*Populus pyramidalis*), aspen (*P. tremula*), and sallow (*Salix Caprea* and *S. cinerea*).

The Lime Hawk (*Smerinthus Tiliæ*)

This beautiful moth (fig. 5, Plate IX) is easily identified by its rich olive green and brown wings, the fore pair of which have very conspicuous patches of deep olive, sometimes uniting to form a ontinuous central bar. It flies in May and June.

aterpillar is rough, of a pale green colour, dotted with yel- seven oblique yellow stripes on each side. Thus it is very of *Populi*, but may be distinguished from that species racles, and by the horn, which is rough, blue above, and yellow beneath. Behind the horn, too, there is a flat purple or violet scale with an edging of orange.

The food plants of this species are the lime (*Tilia vulgaris*), elm (*Ulmus campestris*), and the hazel (*Corylus Avellana*), from which the larvæ may be beaten in August and September, and from under these the pupæ may be dug out during the winter months.

The Humming-Bird Hawk (*Macroglossa Stellatarum*)

The genus to which this insect belongs contains three interesting British species. Their antennæ are thickened toward the end, but terminate in a small curved bristle. Their wings are rather short and broad; their bodies are very thick, terminating in a broad tuft of hair; and the perfect insects fly during the daytime, delighting in the hottest sunshine. The larvæ feed principally on low-growing plants, and undergo their metamorphoses on the ground among the foliage.

On Plate IX (fig. 6) one of these pretty moths is shown. It is the Humming-bird Hawk, so called on account of its exceedingly rapid humming-bird-like flight, accompanied by a soft humming sound.

This insect is very common; and, being very partial to the attractions offered by many of our favourite garden flowers, it ought to be well known to all observers of nature.

Take your stand near a bed of petunias or verbenas, or close to a honeysuckle in bloom, on any hot summer's day, and you are almost sure to be rewarded by a peep at the wonderful flight and interesting ways of this moth. It makes its appearance so suddenly that you first view it as an apparently motionless insect, suspended in the air, and thrusting its long proboscis into the tube of an attractive flower. Its wings vibrate so rapidly that they are quite invisible, and give rise to the soft hum already mentioned. Then it darts from one flower to another, making a similar brief stay before each while it sucks the grateful sweets. Raise your hand as if to strike, and suddenly it vanishes you know not where. But it is as bold as it is wary, and will often return to the selfsame flower as if to defy your power. A sharp sweep of your net in a horizontal direction, or a sudden downward stroke, *may* secure it; but if you miss it, as you probably will, it will disappear like a phantom, and give you no opportunity of making a second attempt.

This moth is on the wing throughout the hottest months of the year – May to September, and will often greet you as you roam over flowery banks in search of butterflies.

The caterpillar feeds on the lady's bedstraw (*Galium verum*), hedge bedstraw (*G. Mollugo*), and the goose grass (*G. Aparine*), and may be searched for in August and September. It is rough, green or brownish, and dotted with white. Along each side are two light lines. The horn is thin and short, rough, and points upwards.

The Broad-bordered Bee Hawk (*Macroglossa Fuciformis*)

The two other moths of this genus are called Bee Hawks from their resemblance to the humble bee. They are very much alike, but may be distinguished by a difference in the width of the dark border of the wings; and are named Broad-bordered and Narrow-bordered respectively.

The former is illustrated in the woodcut appended. The fore wings are transparent like those of bees, with a dark central spot and a broad reddish-brown hind margin. The base and costa are black and tinged with green. The hind wings are similarly coloured, but have no central spot. The body is olive-brown, with a broad reddish belt, and behind are tufts of hair, which are spread out when the insect flies, just after the manner of the tail feathers of a bird. The moth flies in May.

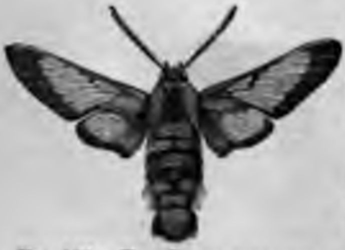


FIG. 102.—THE BROAD-BORDERED BEE HAWK.

The larva resembles that of *Stellatarum*, but exhibits a violet tint above the legs. Its horn, too, is curved, and of a reddish or brownish colour. It feeds on the honeysuckle (*Lonicera Periclymenum*), ragged robin (*Lychnis Flos-cuculi*), evening campion (*L. vespertina*), red campion (*L. diurna*), lady's bedstraw (*Galium verum*), and the field scabious (*Scabiosa arvensis*), during the month of July.

Family SESIIDÆ—THE CLEARWINGS

This family contains fourteen very pretty British insects that differ very much from other moths in many important and interesting particulars.

Their antennæ, like those of the *Sphingidæ*, are thickest beyond the middle, and those of the males are slightly *ciliated* or hairy. Their bodies are slender, and terminate behind in tufts of hair. The hind wings in all cases are transparent, margined and veined with black or brown; and the fore wings also, in most cases, have transparent bases.

These moths delight in the hottest sunshine, and may be seen gracefully hovering over the flowers in our gardens, looking more like gnats, bees, and wasps, than moths.

The larvæ of these insects are all wood eaters, and spend their time within the stems of shrubs and trees, eating out galleries in the material that forms both their food and their home. Within these they also undergo their changes, and do not expose themselves to the free air and light till they reach their perfect stage.

The Hornet Clearwing of the Poplar (*Trochilium Apiformis*)

We can find space for a mention of only two of the clearwings, the first of which is an insect that closely resembles the dreaded hornet, and whose larva feeds in the stems of poplars—features which will account for the above name.

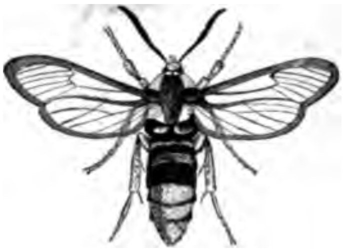


Fig. 103.—The Hornet Clearwing of the Poplar.

The head of this species is yellow, its thorax brown with a large yellow patch on each side, its abdomen yellow with two brown belts, and its legs reddish orange. The front wings are transparent, with brown costæ, and all the wings are margined with brown.

The caterpillar, when full fed, makes a cocoon with silk and the chips of wood that it has bitten off; and in this undergoes its metamorphoses. It is fully grown in April, and the moth flies from the end of May to the end of July.

There is another 'Hornet Clearwing,' the larva of which feeds on the stems of osiers. It may be distinguished from the species just described by a yellow 'collar' between the head and thorax, both of which are blackish.

The Currant Clearwing (*Sesia Tipuliformis*)

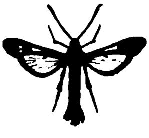


Fig. 104.—The Currant Clearwing.

This is by far the commonest of all the Clearwings, and only too well known to those who grow currants. Examine the shoots of *Ribes rubrum* (red currant) and *R. nigrum* (black currant), especially those that present a withered or half-withered appearance, and you will almost certainly meet with signs of the presence of this intruder. Little wriggling larvæ occupy the pithless stems throughout the winter and spring. These are full grown in April, and in June the pretty little moth emerges through a hole in the side of a shoot, leaving the empty pupa case within its former home.

The fore wings of this moth have black margins, and a black transverse bar beyond the middle. The body is black, with three pale yellow belts, and black tufts of hair at the tip.

Family—Zygænidæ

The remaining family of the *Sphinges*—the *Zygænidæ*—includes seven British species, three of which are known popularly as the Foresters and the others as the Burnets.

Their antennæ are thickest beyond the middle, but do not terminate in a hook. Their wings are narrow and completely covered with scales.

These moths are very sluggish creatures, spending the greater part of their time at rest on the stems of low-growing plants. When they do fly, their flight is short and heavy, and their pretty wings glisten in the sunshine (for they are lovers of the sun), giving them the appearance of bees rather than of moths. On account of this natural sluggishness, they are exceedingly local, for they never move far from the spots where their food plants abound, and where they had previously spent the earlier stages of their existence. Thus we often come across a very limited piece of ground actually alive with them, and outside which not a single specimen is to be seen.

larvæ, too, are sluggish creatures, with soft and plump al bodies and no horns. I will briefly describe three of this family.

The Forester (*Ino Statices*)

The fore wings of this species are semi-transparent, and of a beautiful glossy green. The hind wings also are semi-transparent, but of a dull smoky tint. The thorax and abdomen are both of a brilliant metallic green colour. The tips of the antennæ are blunt, and the male may be distinguished from his mate by these organs being slightly fringed or ciliated.

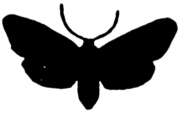


Fig. 105. The Forester.

The caterpillar is dingy grey or greenish, with a row of black spots down the back, and a whitish stripe on each side. It feeds on the common sorrel (*Rumex acetosa*) and the sheep sorrel (*R. acetosella*), and when fully grown it spins a cocoon on the stem of its food plant, and there changes to a chrysalis.

The larva may be found during May and early June. The chrysalis state lasts only a few days, and the moth is on the wing during June and July.

The Broad-bordered Five-spotted Burnet (*Zygæna Trifolii*)

On Plate IX (fig. 7) will be found a coloured representation of this Burnet. The two crimson spots in the base of the fore wing are very close together, and often touch. The same remark also applies to the two spots on the middle of the wing. A glance at the list of British Moths (Appendix I) will show that we have also a *Narrow*-bordered Five-spotted Burnet. This insect is very similar to the species now under consideration, but may be identified by the narrower purplish margin on the hind wings, and also by the shape of the antennæ, which are not thickened so much near the end as they are in *Trifolii*.

The larva of the present species is yellowish or greenish, with a row of black spots on the back and a row on each side. It feeds on the bird's-foot trefoil (*Lotus corniculatus*), hop trefoil (*Trifolium procumbens*), and the horse-shoe vetch (*Hippocrepis comosa*) in May. Late in May or in early June the chrysalis may be found in a silken cocoon attached to a stem or leaf; and the perfect insect flies during June and July.

The Six-spotted Burnet (*Zygæna Filipendulæ*)

So common is this moth, and so conspicuous when it flies in the blazing sun, that it must be familiar to almost everybody. On a bright midsummer day hundreds may often be started from their grassy beds from one little patch of ground.

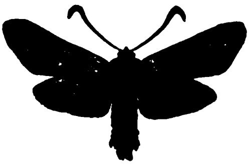


FIG. 106.—THE SIX-SPOTTED BURNET.

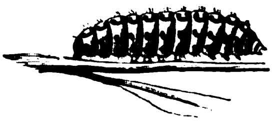


FIG. 107.—THE LARVA OF FILIPENDULÆ.

The colouring of the wings is much the same as in the last species, but there are two crimson spots instead of one near the tips of the fore pair.

The larvæ may be seen in vast numbers during May and June, feeding on clovers (*Trifolium pratense* and *T. repens*), and the bird's-foot trefoil (*Lotus corniculatus*); and in the latter month thousands of the chrysalides, inclosed in shuttle-shaped cocoons on grass stems, may be seen on downs and sunny banks in almost every part of the country.

The caterpillar, which is yellow, may be known by the two rows of black spots that adorn each segment of the body.

CHAPTER XVIII

BOMBYCES

THIS tribe is an important one, inasmuch as it contains those few moths whose silk is of present or anticipated commercial value. Many of the British members, even, make silken cocoons of moderate compactness, but none of them yield a quantity and quality of silk to justify any attempt to utilise it in the arts.

There are more than a hundred British species in this group, and these represent no less than seventeen families, which exhibit a great variety in their general appearance and habits.

Family—NYCTEOLIDÆ

The Green Silver-lined (*Hylophila prasinana*)

This family, under the name of *Chloephoridæ*, is included by some authors among the *Tortrices* (page 298), which they somewhat resemble in habits. It contains only four species, of which we will take one example—the Green Silver-lined.

The fore wings of this insect are pale green, with three oblique silvery white lines, the middle one of which is far more distinct than the other two. The hind wings are silvery white in the female, and yellow in the male. It flies in May, and is common in the wooded districts of the south-eastern counties.

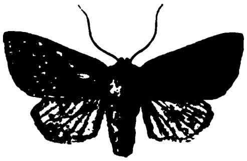


FIG. 108.—THE GREEN SILVER-LINED.

The caterpillar is pale green, dotted and striped with yellow, and has a reddish transverse band on the second segment. It feeds on oak (*Quercus Robur*), birch (*Betula alba*), hazel (*Corylus*

Avellana), beech (*Fagus sylvatica*), and alder (*Alnus glutinosa*), from which trees it may be beaten in July and August.

Family—NOLIDÆ

The Short-cloaked Moth (*Nola cucullatella*)

We select this common moth as a representative of the small family *Nolidæ*, which contains only five British species. These are all small insects. They are nocturnal in their habits, and may be found at rest on the trunks of trees during the daytime. The caterpillars are hairy, and undergo their metamorphoses within silken cocoons.

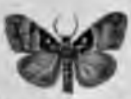


FIG. 109.—THE SHORT-CLOAKED MOTH.

The fore wings of *Cucullatella* are pearly grey, with a dark patch at the base, a triangular spot on the middle of the costal margin, and wavy lines beyond this, parallel with the hind margin. The hind wings are grey, and devoid of any markings.

The caterpillar is of a brownish colour, with a line of lighter patches down the back, and it is covered with little tufts of hair. It feeds on the blackthorn (*Prunus spinosa*), whitethorn (*Cratægus oxyacantha*), and also on plum trees in our gardens during the month of May. The moth is on the wing during June and July.

Family—LITHOSIIDÆ

The Muslin Moth (*Nudaria mundana*)

The family *Lithosiidæ* contains several small moths, distinguished from the other *Bombyces* by the narrowness of their fore wings. When the insects are at rest, all the wings are wrapped closely round the body. They fly at dusk on summer evenings, but may be obtained during the daytime by beating the boughs of trees. If an open net be held under the boughs during this operation, the moths will generally feign death and allow themselves to fall into it when they are disturbed.

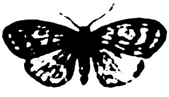


FIG. 110. THE MUSLIN MOTH.

Most of the larvæ of this family feed on the lichens that cover walls and the bark of trees, and they conceal themselves so artfully among this peculiar vegetation that it is no easy matter to search them out; probably many still remain unknown to entomologists.

Our first example—the Muslin Moth—has light brownish-grey and semi transparent wings, the front pair of which have darker markings arranged as shown in the illustration. It is a common moth, and may be met with in July and August.

The caterpillar feeds on lichens in June. It is of a dull grey colour, with a yellow stripe down the back, and has numerous little tufts of light hair.

The Common Footman (*Lithosia lurideola*)

The fore wings of this species are of a leaden grey, with a bright yellow costal stripe which dwindles to a point just before it reaches the tip. The hind wings are very pale yellow.

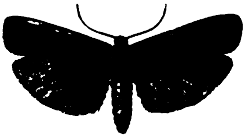


Fig. 111.—The Common Footman.

The larva is black, with a reddish line on each side just above the feet. It may be found during May and June among the lichens of oaks, blackthorns, and firs, especially in the woods of the south of England.

The perfect insect flies during July and August.

Family—Eucheliidæ

The Cinnabar (*Euchelia Jacobæa*)

The family *Eucheliidæ* contains only four British species, two of which must receive a share of our attention. The first of these is the Cinnabar Moth, which is common in all localities where its food plants—the groundsel (*Senecio vulgaris*) and the ragwort (*S. Jacobæa*)—abound.

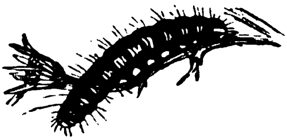


Fig. 112.—The Larva of Jacobæa.

Its colours are so striking that a glance at its representation (fig. 1 of Plate X) will render a written description quite unnecessary.

The caterpillar is a very familiar and conspicuous object. Its colour is bright orange, broken by several broad black rings; and its body is thinly covered with hair. When fully grown (July or

August) it descends to the ground, and there changes to a smooth and shining reddish-brown chrysalis.

The moth appears in June or early in July.

The Scarlet Tiger (*Callimorpha Dominula*)

This is certainly one of the most beautiful of all our moths. Its fore wings are dark olive green, with a lovely metallic lustre, and boldly marked with large white and yellow spots. These spots are arranged generally like those in the illustration, but are subject to great variation. The hind wings are crimson, with large black patches, chiefly distributed near the hind margin. The thorax is black, with two white streaks; and the abdomen crimson, with a black line down the back.

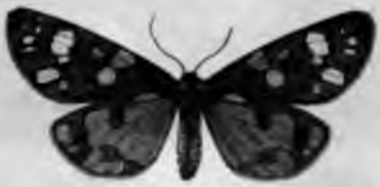


FIG. 113.—THE SCARLET TIGER.

This moth is a common one. It may be taken in June and July. I have seen it flying somewhat freely while the sun was still shining brightly.

The caterpillar is very dark lead colour, nearly black; and is covered with little wart-like projections, from each of which protrudes a short black hair. There is a broad yellow broken line down the back, and two others on the sides. It feeds on the hound's-tongue (*Cynoglossum officinale*) and many other low-growing plants, hybernates through the winter, and is fully grown in May. Like the other members of this family, it spins a light silken cocoon, in which the hairs from its body are interwoven.

Family—CHELONIIDÆ

The Wood Tiger (*Nemeophila Plantaginis*)

The *Cheloniidæ* are popularly known as the Tigers—a title suggested by the tiger-like colouring of some of the prominent species. They differ from the Scarlet Tiger and the other members of the *Euchelidæ* in that the males have ciliated or fringed antennæ. The larvæ, too, are more densely covered with hair.

The Wood Tiger (fig. 2, Plate X) is a beautiful insect, somewhat variable in its markings, but so conspicuously coloured that our illustration cannot fail to lead to its identification. It may be found commonly among the undergrowth of our southern woods during May and June.

The caterpillar is dark brown or brownish black, covered with little hair-bearing warts. The hairs are long and black on the foremost and hind segments, but shorter and of a brown colour on the middle of the body. It issues from the egg in September, feeds for a week or two on the leaves of violets (*Viola canina* and *V. odorata*), heartsease (*V. tricolor*), plantain (*Plantago*), or groundsel (*Senecio vulgaris*), and then hybernates till the following March. It is fully grown in May, and then spins a light cocoon, with which its hairs are interwoven, among the leaves of its food plant.

The Tiger (*Arctia caia*)

This splendid moth is exceedingly variable in its colour and markings, but its usual appearance corresponds closely with that of the illustration on Plate X (fig. 3). In some specimens the cream colour almost entirely covers the fore wings, while in others all four of the wings are completely covered with shades of brown. This insect is probably known to all my readers, for it is abundant everywhere.

The larva is as well known as the perfect insect. It is a kind of universal feeder, partaking readily of almost every low-growing plant, with perhaps a special partiality for dead nettles (*Lamium album* and *L. purpureum*). It feeds also on the lime tree (*Tilia vulgaris*), and is commonly met with on apple trees and on the various plants of our flower beds. The young caterpillar makes its appearance in the autumn, and hybernates after feeding for two or three weeks only. It is full grown in June, when it spins a silken cocoon, and changes to a shiny black chrysalis.

The ground colour of the larva is black, but it is covered all over with long hairs, those down the middle of the back being grey, and the others brown. This familiar larva is known popularly as the Woolly Bear.

The Cream-spot Tiger (*Arctia villica*)

There is yet another Tiger—the Cream-spot—too beautiful and too common to be excluded from our list. It is represented on Plate X (fig. 4); and, like the others of its genus, is so boldly marked that mistaken identity is impossible.

It is a very sluggish moth, more often seen at rest than on the wing, and will suffer itself to be roughly handled without making any attempt to escape.

The caterpillar may be observed on sunny banks, generally feeding on chickweed (*Stellaria media*) but sometimes on various other low-growing weeds, including the dock and the dandelion. Its colour is black, with red head and legs, and its body is covered with long brown hairs. It commences to feed in the autumn, hybernates throughout the winter, and is full grown in May, towards the end of which month it changes to a black chrysalis within a light silken web.

The perfect insect appears in June.

The Buff Ermine (*Spilosoma lubricipeda*)

The *Chelowiidæ* also include three moths that are popularly known as the Ermines, two of which—the Buff and the White—are exceedingly common, and are among the constant visitors to our gardens during June and July.

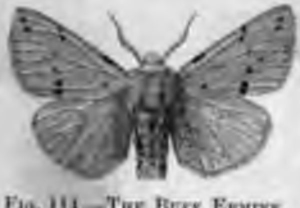


Fig. 114.—The Buff Ermine.

The Buff Ermine has all four wings of a buff or ochreous tint, and spotted with black as here represented.

The caterpillar is whitish, with a white line down the middle of the back, and its body is covered with long light brown hairs. It feeds on the dock (*Rumex*) and many other low-growing plants during August and September, and spends the winter in the chrysalis state, lying within a loose cocoon on the surface of the ground.

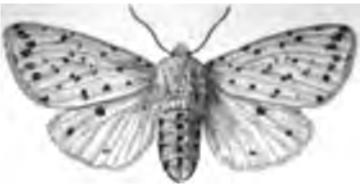


Fig. 115.—The White Ermine.

The White Ermine (*Spilosoma Menthastri*)

In this species the wings are of a pale cream colour, and the dots of the fore wings are more uniformly distributed than in the last. Its habits and life history closely correspond with those of *Lubricipeda*, and its larva may be found feeding on the same plants.

This latter may be distinguished from the caterpillar of the last species by the dark brown or black colour of the body, and the presence of an orange line down the back. It is covered with long brown hairs.

Family—HEPIALIDÆ

The five species which compose this family are known as the Swifts, a title which they have earned by their rather rapid flight. Their wings are narrow, and the antennæ very short.

In the larval state they are long, naked and unsightly grubs, that live under the surface of the ground and feed on the roots of plants. The chrysalides are armed with short spines projecting from the segments.

The Ghost Swift (*Hepialus Humuli*)

One of the commonest of these moths is the Ghost Swift, which may be seen in hundreds on waste places in the south of England during the month of June. The wings of the male are white, with a silky gloss, and a very narrow brown margin. The fore wings of the female are yellow, marked with irregular reddish lines. The hind wings are of a dull smoke colour.

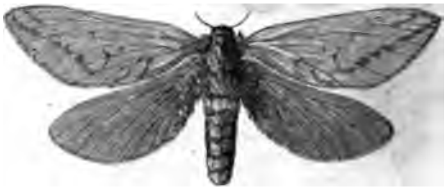


FIG. 116. -THE GHOST SWIFT—FEMALE.

The larva is pale yellow, with a brown head, and a brown horny plate on the front of the second segment. It feeds throughout the winter on the roots of numerous plants, including the dock, dandelion, burdock, white dead nettle, black horehound, and the hop.

The Common Swift (*Hepialus lupulinus*)

The fore wings of the male of this species are brown, with a bent whitish streak, sometimes broken, passing from the base to the middle of the inner margin, and then to the apex. The hind wings are smoke coloured, with a light brownish fringe. The female is much less distinctly marked, and presents a rather dingy appearance.

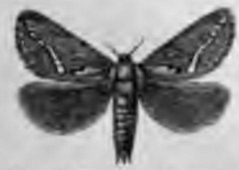


FIG. 117.—THE COMMON SWIFT.

The larva is dingy white, with brown horny plates on the second, third and fourth segments. It feeds on the roots of dead nettles (*Lamium album* and *L. purpureum*), black horehound (*Ballota nigra*), and various other herbaceous plants, throughout the winter months, and is full grown in April.

This insect is abundant everywhere in waste places, and may be seen on the wing in May and June.

Family—COSSIDÆ

The members of this family have longer antennæ than the *Hepialidæ*, and the females are provided with extended ovipositors which enable them to place their eggs in the deep crevices of the bark of trees.

The larvæ are naked or only very slightly hairy, and have a plate on the second segment. They feed on the wood of trees or the interior of the stems of reeds. The pupæ have spiny projections on each segment.

The Goat Moth (*Cossus ligniperda*)

There are only three British species of this family, the largest of which is the Goat Moth, so called on account of the characteristic odour of the larva, an odour said to resemble that emitted by the goat.

The fore wings of this fine moth are pale brown, clouded with white, and marked by numerous wavy transverse lines. The hind wings are somewhat similar, but of a duller tint, and the markings are less distinct. Its average breadth from tip to tip is over three inches, and it sometimes reaches nearly four inches.

The larva is a most interesting creature. It is dark reddish brown on the back, and flesh colour beneath; and its head is intensely black. It feeds on the solid wood of the willow, poplar, oak, elm, and other trees. The infected trees are often so riddled with the burrows of these larvæ that they are completely destroyed, and the presence of the intruders is frequently indicated by a heap of small chips of wood lying on the ground near the roots. The odour of the larvæ, too, is so powerful, that there is generally no difficulty in ascertaining their whereabouts by it alone.

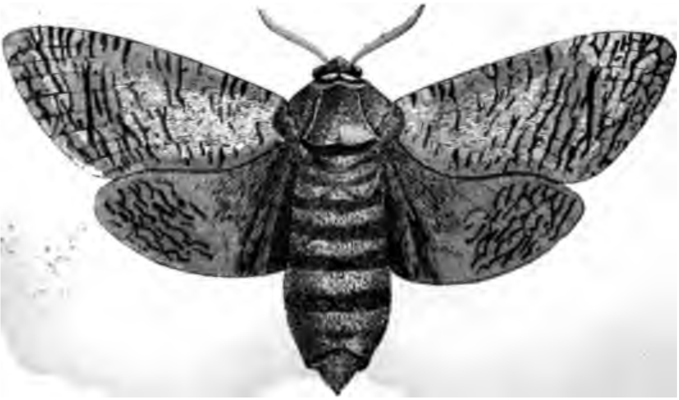


Fig. 118.—The Goat Moth.

It is not always in living trees, however, that we find these creatures, for they often feed on rotting wood, such as the remains of old palings and posts, that lie on the ground in damp places.

When fully grown they construct a strong cocoon of chips of wood, bound together by silk, and within this they change to the chrysalis.

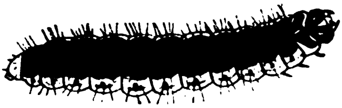


Fig. 119.—The Larva of Ligniperda (less than half full size).

The moth emerges in June or July, and is commonly found resting on the bark of willows and poplars during the daytime.

The Leopard Moth (*Zeuzera pyrina*)

The wings of this species are white and semi-transparent, and marked with numerous bluish-black spots in such a way as to remind one of the skin of the leopard. Its body is very long, and the antennæ of the male are doubly fringed for about half their length from the base.

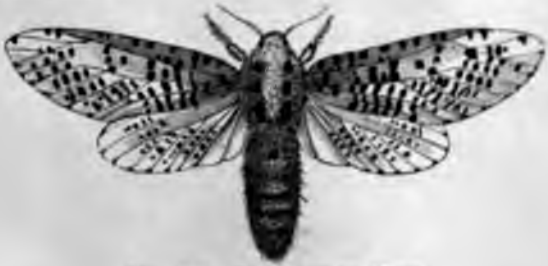


FIG. 120.—THE LEOPARD MOTH.

The caterpillar feeds on the wood of various trees—elm, apple, pear, ash, alder, poplar, horse chestnut, birch, lilac, and several others. It is yellowish, with black shiny spots, and a black plate on the second segment.

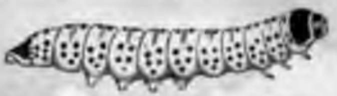


FIG. 121.—THE LARVA OF PYRINA (ONLY PARTLY GROWN).

The moth appears in July, and is widely distributed. It is attracted by bright lights, but the best way to obtain it is to search the trunks and branches of trees that are known to harbour the larvæ early in the morning, and so obtain newly emerged specimens.

Family—LIPARIDÆ

Passing over the two small species which are the only British representatives of the family *Cochliopodidæ*, we come to the interesting *Liparidæ*, the remarkable feature of which is that most of the caterpillars are adorned with brush-like tufts of hair, and even the chrysalides are hairy.

The perfect insects are not brilliantly coloured, but generally display very pale tints; and the antennæ of the males are pectinated or feathered.

The Brown Tail (Porthesia chrysorrhœa)

The family contains two moths—the Brown Tail and the Yellow Tail—that are very similar in appearance and habits. Both have white wings, and their bodies also are white with the exception of the tuft of coloured hair at the tip of the abdomen, which gives the names to the species. Their larvæ may both be found feeding on the same trees (whitethorn), and both change to a brown hairy chrysalis within a loose cocoon among the leaves.

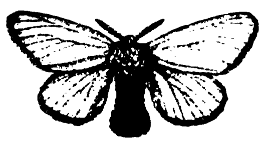


Fig. 122.—The Brown Tail.

The larva of *Chrysorrhœa* is black, with four rows of little wart-like projections on each side, from which proceed little tufts of hairs. These hairs are reddish with the exception of one row on each side, which is white. The tenth and eleventh segments have each a scarlet tubercle, and there are also other small spots of the same colour on some of the front segments.

The larva feeds on the blackthorn in addition to the tree mentioned above, and is full grown in June. The moth flies in August.

The Gipsy (*Ocneria dispar*)

The fore wings of the male are smoky brown, with darker markings, including a V-shaped black mark near the centre. The hind wings are brown, darker near the margin. The female is dingy yellowish white, with darker markings arranged as in the male. The male is much inferior in size, and its antennæ are very strongly pectinated.

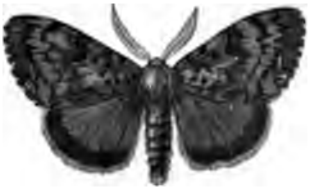


Fig. 123.—The Gipsy—Male.

The larva is brownish black, finely dotted with yellowish grey. There is a grey stripe down the middle of the back, and six tubercles on each segment give rise to tufts of long hair. It feeds on the whitethorn (*Cratægus oxyacantha*), blackthorn (*Prunus spinosa*), and various fruit trees.

The caterpillar is full grown in June, and the moth appears in August.

The Black Arches (*Psilura Monacha*)

The fore wings of the Black Arches are white, marked with zigzag black lines, as shown in our illustration. The hind wings are smoky grey. The hinder segments of the abdomen are banded with black and rose-pink. The male is much smaller than the female, and has the antennæ strongly pectinated.

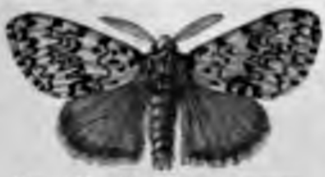


FIG. 124.—THE BLACK ARCHES—MALE.

The caterpillar is hairy, and of a greyish-white colour. A brown stripe runs down the back. On the top of the second segment are two blue tubercles; and there is also a tubercle, of a reddish colour, on each of the ninth, tenth, and eleventh segments. It feeds on the oak, birch, fir, and the apple; and is full grown in June or July.

The moth flies during July and August.

The Vapourer Moth (Orgyia antiqua)

During the hottest summer months, and particularly in August and September, a rather small brown moth may be seen almost everywhere, flying rapidly and in a very erratic manner in the bright rays of the midday sun. This is the common Vapourer Moth, which may be known at once by its bright chestnut colour, with darker transverse markings, and a white crescent-shaped spot in the anal angle of the fore wings. It seems somewhat partial to civilised life, for it frequents the streets of our metropolis, even in the very densely populated parts; and the larva is one of the commonest of the insect forms infesting our gardens and squares.

FIG. 125.—THE VAPOURER MOTH—MALE.

FIG. 126.—THE FEMALE VAPOURER

The caterpillar is variously coloured; but the prevailing tints are dark brown, grey, and pink. On the second segment are two long tufts of hair directed forward, and on the twelfth segment a similar tuft directed backward. On each of the segments five to eight inclusive is a brush-like tuft of yellowish hairs. It feeds on almost every tree usually to be found in parks and gardens.

When fully grown it spins a web on the bark of a tree, or on a wall or fence, and changes to a hairy chrysalis.

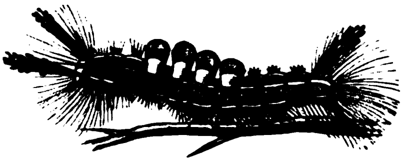


Fig. 127.—Larva of the Vapourer Moth.

The female of this species is wingless, and never moves away from the cocoon out of which she has crawled, but lays her eggs on the outside of the silken web, and there remains to die.

The clusters of eggs may be found in abundance throughout the winter months.

Family—Bombycidæ

This family contains eleven thick-bodied moths, mostly of large size, in which the predominating colours are greys and browns. Their hind wings are generally paler than the front pair, and less distinctly marked; and the antennæ of the males are pectinated.

The caterpillars are very hairy, but the hairs are uniformly distributed, and not arranged in tufts as in the larvæ of the last family.

The chrysalides are inclosed in silken cocoons, but are not hairy.

We shall briefly examine three of the members of this family.

The Oak Eggar (*Bombyx Quercus*)

The male of this species is shown on Plate X (fig. 5). The female is much larger, and of a pale tawny colour.

The ground colour of the caterpillar is black; but it is so closely covered with short yellowish brown hairs that the black is scarcely visible, excepting when the creature rolls itself up into a ring, which it does when alarmed. The spiracles are white, and there is a series of white spots down the middle of the back and along each side. It feeds on whitethorn (*Cratægus oxyacantha*), heather (*Calluna*, *Erica*), poplar (*Populus nigra*), and various other plants and trees.

As a rule the larva hybernates through the winter, is full grown in the following May, and the moth appears in July; but in Scotland the caterpillar does not spin its cocoon till September, hybernates in the chrysalis state, and emerges in the following June. The same is true of the Cornish Eggars; but along the coast of South Devon both varieties are to be met with.

The male Eggar seems to enjoy the bright sunshine, for I have seen large numbers flying over the rugged cliffs of the south-west throughout all hours of the day.

The Drinker (Odonestis potatoria)

The popular name of this species is applied on account of a peculiar feature of the larva, which sucks up the dewdrop that lies on its food plant.

The colour of the male is tawny and brown, with a reddish tinge; that of the female is yellow. The front wing has an oblique dark bar passing from the apex to the middle of the inner margin; also two white spots—one in the middle of the wing, and the other between it and the costal margin.

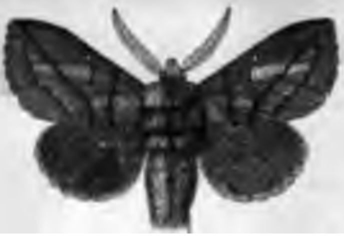


FIG. 128.—THE DRINKER—MALE.

The caterpillar is dark bluish grey above, and has a line of orange spots on each side. Along the spiracles are oblique orange streaks, and a series of tufts of white hair. It feeds on the annual meadow-grass (*Poa annua*), and several other grasses. It is a hybernator, commencing its caterpillar state in the autumn, and reaching its full dimensions about the end of the following May.

The moth flies during July and August.

The Lappet (Lasiocampa quercifolia)

Our last example of the *Bombycidæ* is the Lappet (Plate X. fig. 6), a large moth, the female often measuring considerably over three inches from tip to tip. The wings are of a rich reddish brown, and exhibit a beautiful purplish bloom in a newly emerged insect. Scalloped black lines pass transversely across each wing, and a small black dot lies near the centre of the fore wings.

The caterpillar is very variable in colour, but is usually grey or reddish brown. A deep purple band lies between the second and third segments, and another between the third and fourth. On the twelfth there is a small hump, and a pale stripe, more or less distinct, runs along each side. It feeds on the blackthorn (*Prunus spinosa*), buckthorn (*Rhamnus catharticus*), and the white willow (*Salix alba*).

The moth is not uncommon, and is on the wing in June.

Family—ENDROMIDÆ

The Kentish Glory (*Endromis versicolor*)

The beautiful Kentish Glory is the only British representative of its family. The male is shown in Plate X (fig. 7); the female is larger and similarly marked, but its colours are not so bright.

This moth is not common, but may be seen occasionally in the birch woods of the southern counties. The males fly rapidly in the bright sunshine, but the females must be searched for on the bark and branches of the trees.

The eggs are laid in April on the twigs of the birch (*Betula alba*), and the young caterpillar emerges early in May. It is gregarious at first, but loses its social tendencies as it gets older. When full grown, it is of a pale green colour, with white spiracles, a dark green line down the back, and an oblique white stripe on each side of each segment. The sides are dotted with black and brown, and there is a conspicuous hump on the top of the twelfth segment.

When fully grown it spins a cocoon among the dead leaves beneath the tree, and in this it spends the winter months in the chrysalis state.

Family—SATURNIIDÆ

The Emperor Moth (*Saturnia pavonia*)

Here is another family with but one British member; but in this, as in the last case, the only representative is a really beautiful insect. The male *Pavonia* is shown on Plate X (fig. 8), and will need no written description as an aid to its identification. The female is larger, and similarly marked, but the ground colour of the wings is pale grey.

This moth is abundant almost everywhere, and may be looked for in the neighbourhood of heaths and woods early in the month of May.

The larva feeds on a large number of plants and trees, among which may be mentioned the willow (*Salix alba*), blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*), whitethorn (*Cratægus oxyacantha*), bramble (*Rubus fruticosus*), heaths (*Erica tetralix* and *E. cinerea*), and the meadow-sweet (*Spiræa ulmaria*). Its colour is a lovely green; and each segment has several pink tubercles, each surrounded by a black ring, and giving rise to a tuft of short black hairs. The spiracles are orange.

In the autumn it spins a pear-shaped cocoon of silk, open at the small end (fig. 28).

It may here be mentioned in passing that, in the case of some of the larger moths of the few preceding families, the young entomologist is likely to meet with larvæ more frequently than the perfect insect. These moths, however, are mostly very hardy and easily reared; and a beginner cannot do better than endeavour to obtain either ova or larvæ, in order that he may be able to watch the different species through their various stages.

Family—DREPANULIDÆ

We now reach a family containing six small moths that differ in many important particulars from those we have just been considering. They are of such slender build that a beginner may easily mistake them for Geometers. Their wings, though small, are broad, and well proportioned to their bodies. In five cases out of the six the front wings are more or less hooked at the tips, and on this account the moths in question are called the Hook Tips.

The larvæ are not hairy, but they all have little fleshy projections on their backs. Their bodies also taper to a point behind, and the last pair of claspers are wanting, so that they have only fourteen walking appendages. When at rest they usually fix themselves by their claspers only, their pointed 'tails' being directed slightly upward, and all the front segments being also elevated. When about to change, they descend to the ground, and spin their cocoons among dead leaves.

Two only of this family can receive an individual notice.

The Oak Hook Tip (Drepana binaria)

This can hardly be described as a very common moth, but it is fairly plentiful in the woods of the southern counties of England.

Its wings are yellowish brown, marked with two lighter transverse lines. There are two black spots between the lines of the fore wings. The antennæ of the male are pectinated; those of the female simple. The latter sex is further distinguished by the paler colour of the hind wings.

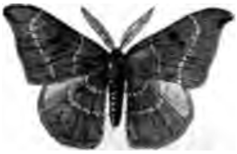


FIG. 129.—THE OAK HOOK TIP.

The larva is brown, with a broad stripe, edged with yellow, down the back. There are two projections on the back of the fourth segment. It feeds on oak (*Quercus Robur*) and birch (*Betula alba*).

This moth is double-brooded, and may be seen on the wing in June and August. The larva may be beaten from the above-mentioned trees in June and July, and again in September.

The Chinese Character (*Cilix glaucata*)

The fore wings of this species are white, with a broad dark blotch from the inner margin to near the costa. The central portion of this blotch is marked with silvery spots which are said to resemble Chinese characters. The hind margin is shaded with a dark grey border, inside which is a row of dark spots. The hind wings are clouded with grey.

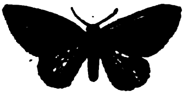


FIG. 130.—THE CHINESE CHARACTER.

This moth is widely distributed, and seems to be common throughout England. It is double brooded, the first brood appearing in May and June, and the second in August.

The caterpillar, which is brown, with two prominent tubercles on each of the third and fourth segments, feeds on the whitethorn (*Cratægus oxyacantha*), and the blackthorn (*Prunus spinosa*).

Family—DICRANURIDÆ

The five British species that represent this family are such interesting insects that we should like to have given a detailed description of all of them, but our limited space will allow of no more than an outline of the general characteristics of the group and a selection of two for individual mention.

They are thick-bodied moths, and the prevailing colours are white and shades of grey. The antennæ are pectinated in the males, and, with the exception of the Lobster Moth (*Fagi*), in the females also.

The larvæ, like those of the last family, have no anal claspers, and stand, when at rest, with both ends of the body raised. They have two 'tails' projecting from the last segment. The largest of them (the Puss), and three smaller species (Kittens) that closely resemble it in habits, all construct hard cocoons to be presently described; but the larva of the Lobster Moth spins a light cocoon among the leaves of trees.

They all spend the winter in the chrysalis state.

The Poplar Kitten (*Dicranura bifida*)

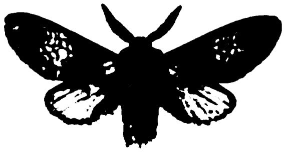


FIG. 131.—THE POPLAR KITTEN.

Our illustration shows the arrangement of the white and grey on the wings of this moth, but the other Kittens (*Bicuspis* and *Furcula*) so closely resemble it that it is necessary to point out a mark of distinction. It will be observed that the fore wings are crossed by a broad grey band, edged with black. This band, in the present species, is almost of the same width throughout, its interior margin being almost straight, and the exterior one slightly concave. In *Furcula*, the outer margin of the band is generally sharply bent inward just below the costa. In *Bicuspis* the grey band varies considerably in shape, but both this and the dark blotch near the tip of the wing are more sharply defined than in the other two species.

The caterpillar is green, dotted with brown, and has a brown stripe on the back. This stripe is broken on the third segment, and widens out on the eighth and thirteenth segments. It feeds on the Poplar (*Populus nigra*) and Aspen (*P. tremula*).

When full grown it descends to the trunk of the tree, and constructs a very hard cocoon of a glutinous substance from its own body mingled with little pieces of the bark that it removes for the purpose. Thus made, the cocoon so closely resembles the surrounding bark that detection is very difficult. I have frequently found these cocoons on the inner surface of loose bark.

This moth is widely distributed, and may be searched for in June and July. The larva feeds during August and September.

The Puss (*Dicranura vinula*)

No written description is necessary in this case, the illustration easily serving for identification. This beautiful moth flies in May and June, and is common everywhere.

The caterpillar is a very interesting creature. It is green, with a hump on the fourth segment, and a patch of brown from the fourth segment to the tail. This patch is very wide on the eighth segment, but tapers to a point on the thirteenth. The two horns are rather long and rough, and from each of them a very slender pink filament is protruded when the caterpillar is irritated.

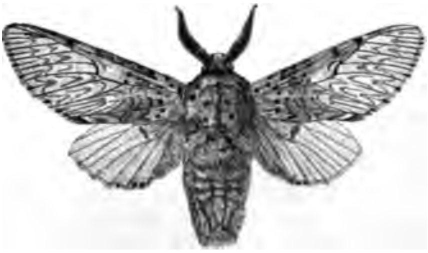


Fig. 132.—The Puss Moth.

It constructs a cocoon very similar to that of *Bifida*, though of course larger, on the bark of the tree on which it fed, generally three or four feet from the ground. It feeds on sallows, willows, and poplars, and may be found during July and August.

Family—Notodontidæ

The Coxcomb Prominent (*Lophopteryx camelina*)

The family *Notodontidæ* contains several moths of somewhat varied appearance, but foremost among them are the 'Prominents,' distinguished by a conspicuous projection on the inner margin of the fore wings.

Our example of this group is the Coxcomb Prominent.

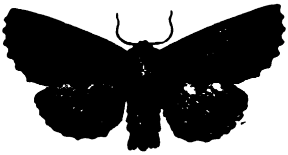


Fig. 133.—The Coxcomb Prominent.

Its fore wings are brown, with darker markings arranged as shown in the illustration; and the hind margins are scalloped. The hind wings are much paler, with a dark brown patch in the anal angle.

The caterpillar is green, with a yellowish line on each side. The spiracles are black, and there are two small humps on the twelfth segment. It feeds during August, September, and October, on various trees, including the oak, birch, poplar, hazel, and alder.

The moth flies from June to August, and is moderately common and widely distributed.

Family—PYGÆRIDÆ

The Buff Tip (Phalera bucephala)

The first of our two examples of this small family is the common and destructive Buff Tip. The perfect insect is represented on Plate X, fig. 9, and is too well known to require a lengthy description. During June and July it may be seen resting on the bark of trees almost everywhere, with its wings folded closely round its body, and its antennæ tucked under the wings, looking just like a piece of stick, or a projection of the bark on which it sits.

The caterpillars appear towards the end of June, and may be seen in dense clusters on lime and other trees, sometimes twenty or thirty huddled together on a single leaf. As they grow larger they retain their gregarious tendencies, and often completely strip the leaves from large branches. They are of a dull yellow colour, hairy, and have seven broken black lines, one along the middle of the back, and three on each side. The head and legs are black.

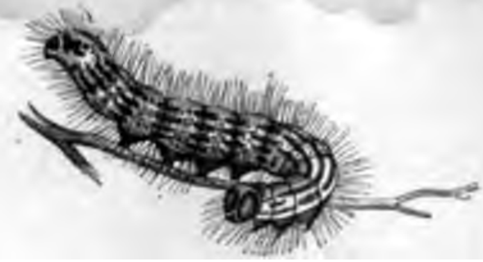


FIG. 134.—THE LARVA OF BUCEPHALA.

When full grown, they descend to the root of the tree, burrow into the soil, and there remain in the chrysalis state till the following June. The chief food plants of this species are the lime (*Tilia vulgaris*), elm (*Ulmus campestris*), and hazel (*Corylus Avellana*).

The Chocolate Tip (*Pygæra curtula*)

This species is not nearly so common as the last, but is to be met with more or less in most of the English counties in the month of May.

Its fore wings are light greyish brown, crossed with four transverse paler streaks, and tipped with a patch of chocolate brown. The hind wings are pale yellowish grey.

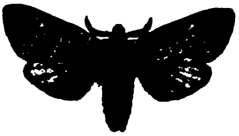


FIG. 135.—THE CHOCOLATE TIP.

The young caterpillars feed in companies between leaves which they have spun together, but when nearly full grown they cease to be gregarious. They are also very different in appearance at different ages. When fully fed, the larva is of a reddish-grey colour, spotted with black, with a double row of orange-coloured warts on each side. There is also a little black hump on each of the fifth and twelfth segments.

The food plants of this species are sallows (*Salix caprea* and *S. cinerea*), poplar (*Populus nigra*), and aspen (*P. tremula*).

Family—CYMATOPHORIDÆ

This, the last family of the *Bombyces*, contains seven species of moderate size, the larvæ of which are either quite smooth or have small warty prominences. The seven species are grouped into three genera, from two of which we shall select a representative.

The Peach Blossom (*Thyatira Batis*)

The popular name of this pretty little moth is given on account of the resemblance of the pink patches of its olive-brown fore wings to the petals of the peach flower. It is a moderately common moth, widely distributed in England and Ireland, and flies during June and July.

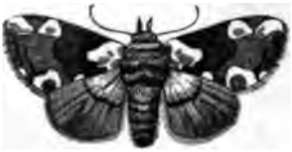


FIG. 136.—THE PEACH BLOSSOM.

The caterpillar is marbled with reddish grey and brown, and has a hump on the third segment, and a smaller prominence on each of the segments six to ten inclusive. It feeds on the bramble (*Rubus fruticosus*) during August and September, and spends the winter in the chrysalis state, inclosed in a loose cocoon among the dead leaves at the root of its food plant.

The Yellow-horned (Asphalia flavicornis)

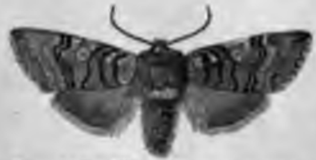


FIG. 137.—THE YELLOW-HORNED.

This is one of the earliest of our moths, appearing on the wing in March, when it may be attracted by means of sugar placed on the bark of the birch (*Betula alba*).

The wings are grey, with a decidedly greenish tinge, crossed by three dark lines near the base, and two others, which are zigzag, just outside the centre. Between these two sets of lines is a conspicuous round pale spot. The hind wings are greyish brown, darker along the hind margin.

The larva, which feeds on the above-named tree, is pale greenish, with both white and black dots. It rolls itself up in a leaf, and seldom ventures out of the retreat thus formed. It is fully fed in July or August.

CHAPTER XIX

THE NOCTUÆ

We have already noticed that several of our moths fly by day; that some come out of their hiding places at dusk, and settle down again to rest before the deepest shadows of night fall; and that others prefer the darkest hours of the night. The tribe of moths we are next to consider includes the greater number (about three hundred) of our truly nocturnal species, hence the name that heads this chapter.

They are generally of a somewhat dingy appearance, the prevailing colours being dull shades of grey, drab, and brown. So closely, in fact, do certain of them resemble each other, that the greatest care has to be exercised in the identification of species—a task that is rendered still more difficult by the variations that we observe in the tints and markings of certain species.

These moths have generally rather stout bodies. Their fore wings are somewhat narrow, and, when the insects are at rest, these are brought close to the body, and the hind pair are folded up beneath them.

Family—Bryophilidæ

The Marbled Beauty (*Bryophila Perla*)

Our first family—the *Bryophilidæ*—contains only four British species. These are small and slender-bodied moths, whose larvæ feed in early morning on the lichens that cover stones and old walls, and conceal themselves by day in holes and chinks and under stones.

The Marbled Beauty is the only moth of this family that may be described as common with us. It is abundant in nearly every English county, as well as in parts of Scotland and Ireland.

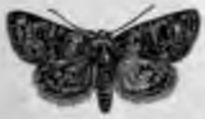


FIG. 138.—THE MARBLED BEAUTY.

Its wings are very pale grey, marked with a darker bluish grey, as shown in the engraving. These markings are variable, but the bases of the fore wings have always a dark blotch, followed by a patch of pale grey or white, extending the whole width of the wing. The moth may be found from the beginning of July to the middle of September.

The larva feeds from February to April. It is black above, with a broad orange-bordered stripe down the back; and its body is covered with small warts, each of which bears a single hair.

Family—BOMBYCOIDÆ

In this family there are sixteen British moths, several of which are exceedingly common. They are much larger than the *Bryophilidæ*, and of a much stouter build. The larvæ are covered with little hair-bearing warts, and are, indeed, often so hairy that they may be mistaken for the caterpillars of the *Bombyces*.

The Grey Dagger (Acronycta Psi)

This is the commonest of all the *Bombycoidæ*. It may be found at rest on tree trunks and palings during the daytime throughout the summer. Its fore wings are pale grey, with four conspicuous black marks, one of which—that in the anal angle—resembles the Greek letter *psi* (ψ) placed sideways.

FIG. 139.—THE GREY DAGGER.

The larva is black or very dark grey, with a pale yellow line down the back, and a black hump on each of the fifth and twelfth segments, that on the fifth being much larger than the other. It feeds in the autumn on lime (*Tilia vulgaris*), blackthorn (*Prunus spinosa*), whitethorn (*Cratægus oxyacantha*), fruit trees, and various other trees, shrubs, and herbs.

The moth called the Dark Dagger (*Tridens*) is hardly to be distinguished from *Psi*. It is not really any darker, and its markings are almost exactly similar; but the larva is very different.

The Poplar Grey (*Acronycta megacephala*)

This is also a very common moth, to be found in all the southern and midland counties, wherever poplars abound, during June and July.

Its fore wings are grey, marbled with a very dark grey. A little inside the middle of these wings, near the costa, is a round spot with a dark centre. This spot is represented in a large number of the *Noctuæ*, and is known as the *orbicular*. It will be observed that in the present species it is very distinct.

The caterpillar is dark grey, with a line of black dots down the back; and it has a number of little warts, bearing hairs. On the back of the eleventh segment is a rather large pale spot. It feeds during August on various species of poplar, and changes to a chrysalis in a crevice of the bark.

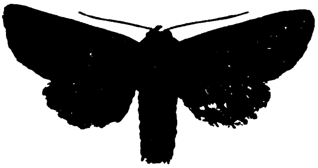


FIG. 140.—THE POPLAR GREY.

The Figure of Eight (*Diloba cæruleocephala*)

The fore wings are brownish grey. Near the middle of the wing, but nearer the costa than the inner margin, are two whitish spots that resemble the figure 8. The hind wings are dull brownish grey, with darker wing rays, and a dark spot near the centre.

This moth is common in all parts, and flies during September.

The caterpillar emerges from the egg in spring, and is fully grown in May or June. It is of a very pale colour—yellowish or greenish—with a broad and broken yellow stripe down the back, and a bluish or greenish stripe on each side. Its head is blue (hence the specific name) with two black spots. It feeds on the hawthorn (*Cratægus oxy-*

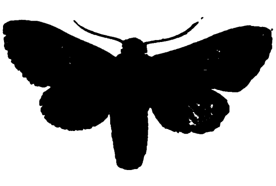


FIG. 141.—THE FIGURE OF EIGHT.

acantha) and various fruit trees; and on the twigs of these (especially the hawthorn) the little clusters of eggs may be seen during the winter.

Family—Leucanidæ

In this family we have a number of rather small moths, with, generally, no markings on their wings, save, perhaps, a few dots or streaks.

Their larvæ feed principally on grasses and reeds, and change to the chrysalis state either in a cocoon among the food plants, or under the surface of the ground.

Several of these insects are very common, and most of them abound in fens and marshes.

The Brown-line Bright-eye (*Leucania conigera*)

The fore wings are yellowish brown. The 'brown line' is a transverse line parallel with the hind margin, and distant from it about one-fourth the length of the wing. Another dark brown line, describing a sharp bend, passes across the wing near the base. The 'bright eye' is a light spot just outside the centre of the wing, nearer the costa than the inner margin. This is another of those marks that occur very constantly in the wings of the *Noctuæ*. It lies beyond the *orbicular* spot, and is usually somewhat kidney-shaped, and is consequently named the *reniform*.

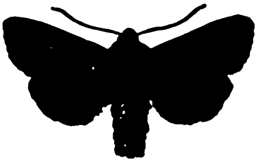


Fig. 142.—The Brown-line Bright-eye.

The caterpillar is yellowish or greyish, with a pale dorsal line edged with black. On each side of this is a broad black line, below which is a yellow line edged with black, then a whitish stripe, next a yellow line edged with black on the upper side, and lastly a broad brownish line, just above the spiracles, edged with black on both sides. It feeds on couch grass (*Agropyron repens*) and various other grasses, and is fully grown in May.

The moth flies in July and August, and is common throughout the United Kingdom.

The Smoky Wainscot (*Leucania impura*)

This same genus includes a number of moths, very similar in general appearance, and popularly known as the 'Wainscots.' Of these we shall take two examples.

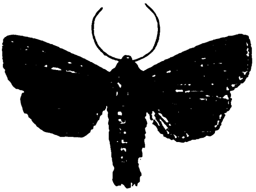


FIG. 143.—THE SMOKY WAINSCOT.

The first is the Smoky Wainscot, so called from the dark smoky tint of the hind wings. Its fore wings are wainscot brown, with lighter rays; and they each have three black dots arranged in the form of a triangle, one in the centre, and the other two between this and the hind margin.

The caterpillar is yellowish, with a fine white line down the back. The spiracles are red, and inclosed in black rings. It feeds on sedges (*Carex*) from March to May.

The moth is on the wing from June to August.

The Common Wainscot (*Leucania pallens*)

This moth is very much like the last. The fore wings exhibit the same three dots, but it may be distinguished by the pale colour of the hind wings.

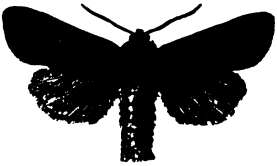


FIG. 144.—THE COMMON WAINSCOT.

The larva feeds on various grasses in March and April. It is of a pinkish grey colour, with two rows of black dots on each side of the dorsal line. There are also three stripes along the side, two of which are brownish and the other grey.

The moth is common everywhere from June to August.

The Bullrush (*Nonagria arundinis*)

Our last example of this family is the Bullrush, a moth that is common in all parts where its food plant abounds.

It is much larger than the two preceding species. The fore wings are yellowish brown, with three parallel transverse lines of black spots. The hind wings are whitish, tinged with brown near the hind margin.

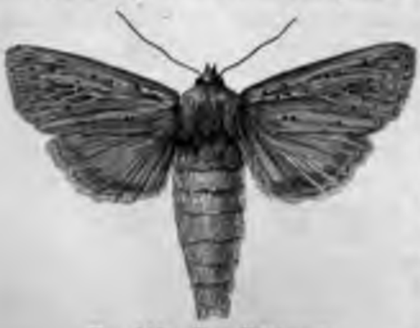


Fig. 145.—The Bullrush.

The caterpillar is of a dull pinkish colour, with a shining brownish plate on the second segment. The spiracles are black. It feeds inside the stems of the reed-mace (*Typha latifolia*), and changes to a chrysalis within the gallery it has excavated, after making a hole through which it can escape when it attains the perfect form.

The caterpillar may be found in May and June, the chrysalis in August, and the moth in September.

Family—Apameidæ

This large family contains no less than forty-four British species, many of which are exceedingly common; and of the others only about half a dozen can be regarded as rare.

Most of them are of medium size, and with one or two exceptions are dressed in rather dingy garbs; but, although the ground colours are dull, the various markings of the wings are sharply defined. They may be searched for on palings and the bark of trees by day, at which time they repose with their wings sloping like the sides of the roof of a house. Some are easily attracted by lights, and others partake freely of the entomologist's 'sugar.'

The larvæ have small retractile heads, and feed on low-growing plants, keeping themselves well concealed on the lower leaves close to the ground.

The Frosted Orange (Gortyna Ochracea)

We commence with one of the brightest members of the family, the Frosted Orange. Its fore wings are dark yellow or ochreous, with distinct brown markings, the chief of which are two broad transverse bands. The orbicular spot is pale yellow and very distinct. The hind wings are dingy yellow. This moth flies from July to September, and is easily attracted by a light at night. It is common everywhere.

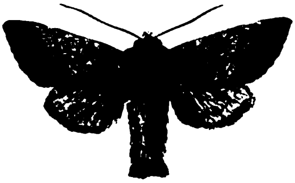


FIG. 146.—THE FROSTED ORANGE.

The larva is yellow, dotted with black, with a brownish plate on the second segment. It feeds inside the stems of a number of plants, including the marsh thistle (*Cnicus palustris*), musk thistle (*Carduus nutans*), burdock (*Arctium minus*), mullein (*Verbascum thapsus*), foxglove (*Digitalis purpurea*), and elder (*Sambucus nigra*). When about to change to the chrysalis it eats *nearly* to the surface of the stem, leaving only a very thin and transparent layer of the epidermis to cover the hole through which it is to escape when it becomes a moth.

The caterpillars are to be found in June, and the chrysalides in July.

The Flame (*Axylia putris*)

This also is a pretty insect, but much smaller than *Ochracea*. It is common in most parts, and may be seen flying in weedy and waste grounds at dusk during June and July.

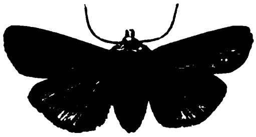


FIG. 147.—THE FLAME.

The fore wings are pale pinkish brown, with dark brown along the costa, and two patches of the same colour on the hind margin. There is also a double line of small brown dots parallel with the hind margin.

The larva is brown, with one yellow and two white dots on each segment. There is also a triangular dark patch on each of the fifth and sixth segments. It feeds during August on the stinging nettle (*Urtica dioica*), and various other low herbs

The Light Arches (*Xylophasia lithoxylea*)

The fore wings of this species are very light ochreous, with a light brown patch on the middle of the costa, and patches of the same colour along the hind margin; also a row of small black dots parallel with the same margin. The hind wings are pale ochreous: they are brownish along the hind margin, and have a light fringe.

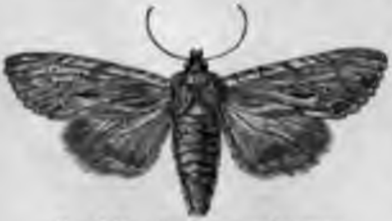


FIG. 148.—THE LIGHT ARCHES.

The moth is very common in waste places, and flies in June and July.

The caterpillar is of a dirty white colour, dotted with black, and has a black head. It feeds on the roots of grasses in May.

The Flounced Rustic (*Luperina testacea*)

The fore wings are greyish brown, with darker umber-brown markings. These latter are variable, but the most conspicuous is a series of dark crescent-shaped spots almost parallel with the hind margin, and immediately outside these is a series of paler crescents.

FIG. 149.—THE FLOUNCED RUSTIC.

The caterpillar is dull flesh-colour, with a brown head, and a brownish plate on the second segment. It feeds on the stems of grasses.

The moth is common throughout the British Isles, and flies in August and September.

The Cabbage Moth (*Mamestra Brassicæ*)

Whatever be your methods of moth collecting, you are sure to meet with *Brassicæ* in abundance. They swarm round the insect hunter's sugar in such numbers as to become a positive nuisance. They are also attracted by light. During the day they may be seen at rest on palings. The caterpillar is even better known, and with reason, for it is fearfully destructive to our vegetables and even our flower beds. It burrows into the hearts of cabbages, filling the galleries it makes with its excrement, often leaving no very visible outward signs of its presence within. But its ravages are by no means confined to cabbages. It eats with more or less relish almost every vegetable and flowering plant of our gardens, and is equally partial to the various herbs of the field.

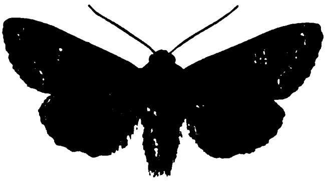


FIG. 150.—THE CABBAGE MOTH.

The fore wings of the moth are dingy brownish grey, marbled in a very confused manner by darker markings. The *reniform* spot is very distinct, the orbicular less so. A light zigzag line runs parallel with the hind margin. It flies in June and July.

The larva feeds later in the season, and changes to the chrysalis beneath the soil in the autumn. It is of a dark grey colour, with a darker line on the back, and a lighter one along the spiracles, which are white.

The Dot (*Mamestra Persicariæ*)

The conspicuous white reniform spot on the very dark marbled fore wings is always sufficient for the identification of this species.

This moth is out in June and July; and during the latter month lays its eggs on the elder (*Sambucus nigra*), and the various low plants that supply the larva with food.

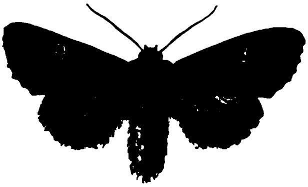


FIG. 151.—THE DOT.

The larva is greenish or greyish, sometimes with a reddish tinge, with a light line down the back. The twelfth segment is humped, and there are dark V-shaped marks on the back of segments five to twelve inclusive. It is full grown in September, and burrows into the ground to undergo its change to the chrysalis, in which state it remains throughout the winter.

The Rustic Shoulder-knot (*Apamea basilinea*)

The fore wings of this species are pale ochreous grey, with light brown markings; and there is a short dark streak in the middle of the base, from which feature the specific name (*Basilinea*) is derived. The hind wings are of a similar colour, but shading into a dark smoke colour at the hind margin.

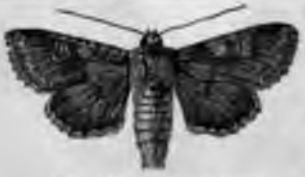


FIG. 152.—THE RUSTIC SHOULDER KNOT.

The caterpillars feed at first on the grains of wheat, on the ears of which the moth deposits the eggs in June. At harvest time they remain hidden among the husks, and are often threshed out in large numbers by the blows of the flail. The cold weather soon overtakes them, and they then spin a cocoon in which to pass the winter. On the approach of spring they come out again, and feed by night on various low plants, hiding themselves among the roots by day. In March they are full grown, and change to brown chrysalides beneath the surface of the ground.

The moth flies in June, and is one of the commonest and most destructive of our *Noctuæ*.

The Marbled Minor (*Miana strigilis*)

The next three genera (*Miana*, *Phothedes*, and *Celæna*) include seven small moths known as the 'Minors.' The commonest of them is the Marbled Minor, which is to be found in abundance everywhere during June and July.

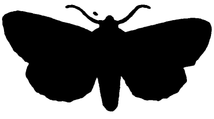


FIG. 153.—THE MARBLED MINOR.

This species is very variable, but the fore wings are usually dark brown, marbled with a lighter colour—white or grey. There is generally an irregular white or pale grey band crossing the wings parallel with the hind margin, and two white marks on the inner margin, halfway between this band and the base. There is also a deep black blotch across the middle of the wing.

The caterpillar is greyish or greenish with paler lines and black spiracles. It feeds on grasses in March and April, and changes to a chrysalis under the ground in May.

Family CARADRINIDÆ

There are only ten British species in this family, two of which are rare; and most of the others are particularly dingy.

The transverse lines so often seen on the fore wings of *Noctuæ* are generally well marked. The larvæ have short stiff bristles, and feed on low plants; they undergo their changes in an earthen cocoon under the ground.

The Mottled Rustic (*Caradrina Morpheus*)

We select as our type of this family the Mottled Rustic—a common moth that may be procured from June to August. Its fore wings are brownish grey, with darker lines and spots; the hind wings are almost white, but darker at the tip.

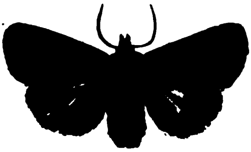


Fig. 154.—The Mottled Rustic.

The caterpillar is brownish grey, with a row of triangular spots on each side of the back. It is very sluggish, spending the greater part of its existence among the roots of low plants. It feeds throughout the winter, except during severe weather, and is full grown in April. The food plants include teasels (*Dipsacus pilosus* and *D. sylvestris*), hedge bedstraw (*Galium Mollugo*), orpine (*Sedum Telephium*), sallows (*Salix*), and various other plants.

The chrysalis may be dug out in May.

Family—Noctuidæ

A glance at our list of British *Noctuæ* (Appendix I) will show that this family contains nearly fifty species and only three genera. It includes several very common moths that frequent our gardens and are to be met with during almost every summer evening ramble.

Most of the species are very dingy, but the half-dozen that comprise the genus *Triphæna* are characterised by the bright colouring of the hind wings. The fore wings are narrow and more or less glossy, and overlap to a greater or less extent when the insects are at rest; and the hind wings are folded and completely hidden beneath them.

The larvæ are rather thick and smooth, and generally of very dingy colours. They feed on low plants, often confining their ravages to the roots, and generally lie well concealed close to the ground or under the surface.

The pupæ are brown, smooth, and shining, and are usually inclosed in earthen cocoons.

We shall briefly notice a few members of each of the three genera.

The Turnip Moth (Agrotis Segetum)

This is another of those destructive insects that attack vegetable and flower gardens, often doing so much damage to our crops as to become quite a nuisance to cultivators.

The moth is decidedly dingy. Its fore wings are brown, clouded with a darker tint. The hind wings are almost white, sometimes with a brown hind margin.

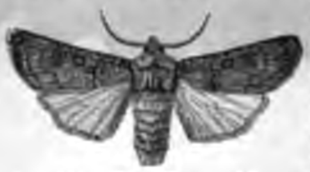


FIG. 155.—THE TURNIP MOTH.

In June it lays its eggs on the stems of young plants, generally very close to the ground. As soon as the young caterpillars emerge they commence feeding on the lower parts of the stems, or burrowing deeply into the larger succulent roots. When the larvæ have completed their work of destruction in this way, they change to brown chrysalides in the ground. Some undergo this change in October, and shortly after give rise to a second brood of moths; but most of them remain in the caterpillar state throughout the winter, and, contrary to the general rule with hybernating larvæ, continue to feed almost throughout the winter months, and change to the chrysalis in the following May.

The caterpillar grows to a large size. It is of a greyish or greenish colour, with a paler line on the back, a light brown line on each side of this, black spots between these lines, and black spiracles.

The Heart and Dart (Agrotis Exclamationis)

The destructive work of *Segetum* is assisted by similar operations of the Heart and Dart, the larva of which feeds voraciously on the roots of several of our cultivated vegetables, though the present species does not entirely confine its ravages to the farmer's crops, but attacks the roots of many low growing herbs.

The fore wings of the moth are light brown, generally with a reddish tinge. The darker markings include a large and very distinct reniform spot, a less distinct orbicular, and a conspicuous longitudinal blackish streak near the base of the wing known as the *claviform*. Beyond the reniform a curved and zigzag dark line crosses the wing. The hind wings of the male are very pale, those of the female darker, with a whitish fringe.

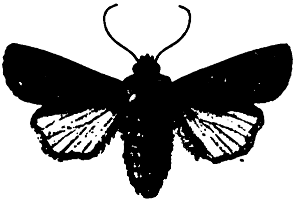


FIG. 156.—THE HEART AND DART.

The moth flies from June to August, and is common everywhere. The caterpillar feeds in the autumn, and reaches its full size in October; but it is said to feed at intervals throughout the winter. Its colour is dingy brown or grey, with paler lines on the sides. The spiracles are black, and there are black dots on the sides.

The Garden Dart (*Agrotis nigricans*)

This is another dingy moth, whose general appearance is so unattractive that the tyro might be inclined to neglect it. But it must not be omitted from our selection on that score, for our main object here is to give the beginner an acquaintance with those species that are most likely to be captured in the earlier part of his career, and this moth is certainly one of those that may be described as 'abundant everywhere.'

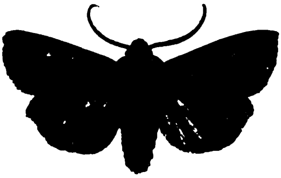


FIG. 157.—THE GARDEN DART.

Its fore wings are dull dark brown, often tinged with red, and clouded with black. The reniform spot is pale, the orbicular spot less distinct, and between the two there is generally a rhomboidal dark spot. There is also a short dark streak near the base of the wing, and a black spot before the orbicular. The hind wings are pale, but smoky towards the hind margin.

The caterpillar is brown and shining, with a fine pale line on the back, and a double white stripe below the spiracles. It is also dotted with black. It is exceedingly destructive, feeding on clovers (*Trifolium pratense* and *T. repens*) and various low plants in May and June.

The moth flies from June to August.

The Flame Shoulder (*Noctua plecta*)

As our example of the next genus we take the Flame Shoulder, a rather small moth, easily identified by the broad yellowish-white streak along the costa of the reddish-brown fore wings. The orbicular and reniform spots are margined with white, and a thin white streak runs from the base of the wing to the former. The hind wings are white. This moth flies in July, and is common throughout Great Britain.

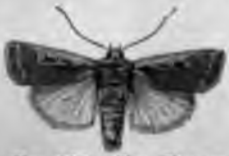


Fig. 158.—The Flame Shoulder.

The caterpillar is reddish brown, with a slender line of white dots on the back, and a similar line on each side. The body is smooth and velvety, and is netted and dotted all over with dark brown. It feeds on the lady's bedstraw (*Galium verum*), sweet woodruff (*Asperula odorata*), and many other low plants; and is full fed early in July.

The Lesser Broad Border (*Triphæna ianthina*)

We now come to the third and last genus (*Triphæna*) of this extensive family, a genus which includes six interesting moths, with bright orange or yellow hind wings. Of these we shall take three examples.

The first of them—the Lesser Broad Border—has fore wings of a rich reddish or violet brown, with paler markings. The hind wings are bright orange, with a broad marginal band of black.

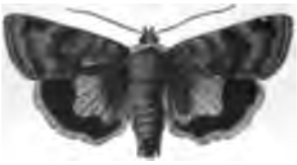


Fig. 159. The Lesser Broad Border.

It is a common moth, particularly in the south-western counties, and flies during July and August.

The caterpillar is of a dingy yellowish or greenish grey, with a light line down the back, and two black spots on each side of segments nine to twelve inclusive. It feeds throughout the winter by night on dead nettles (*Lamium purpureum* and *L. album*), primrose (*Primula acaulis*), whitethorn (*Cratægus oxyacantha*), blackthorn (*Prunus spinosa*), and various low plants; and may sometimes be seen in flower gardens. It is full grown in April.

The Lesser Yellow Underwing (*Triphæna Comes*)

This insect is very similar to the last, but is larger. The fore wings are also of a greyish or ochreous brown, and the black margin of the hind wings is proportionately narrower.

It is more abundant than *Ianthina*; in fact it is to be found everywhere in plenty during the month of July.

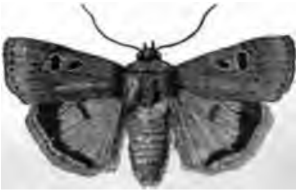


Fig. 160.—The Lesser Yellow Underwing.

The caterpillar is yellowish brown. On the back of each of the eleventh and twelfth segments are two conspicuous dark marks. The spiracles are white, and below them is a pale brown stripe. It feeds on the foxglove (*Digitalis purpurea*), chickweed (*Stellaria media*), thrift (*Armeria maritima*), and other low plants in the autumn, hybernates during the winter, and attacks sallows (*Salix Caprea* and *S. cinerea*) and whitethorn (*Cratægus oxyacantha*) as soon as the buds appear in the spring. It is full grown in April, and then changes to a chrysalis on the surface of the earth.

The Large Yellow Underwing (*Triphæna Pronuba*)

This is by far the commonest moth of the genus, and may be found everywhere, in town and country, from June to August. It is represented on Plate XI (fig. 1), but its fore wings are very variable, sometimes a cold dingy grey, but often of an exceedingly rich and warm brown. On the costal margin, not far from the tip, there is always a small black spot, which will serve to distinguish it from *Comes*.

The caterpillar (fig. 21) feeds throughout the winter on the roots of almost every plant in our gardens; and, during the warmer weather of the autumn and spring, on stems and leaves. It is full grown early in the summer, and then changes to a chrysalis in the ground. Its colour is dirty yellowish or greenish grey, with a row of dark spots on each side.

Family—Amphipyridæ

The Gothic (Mania typica)

The above family contains only four British species, two of which we shall briefly consider.

The first of these is the Gothic—a very common moth that may be seen everywhere about midsummer. Its fore wings are brown with darker marblings, and there are numerous lighter markings which may be easily made out by reference to the accompanying woodcut.

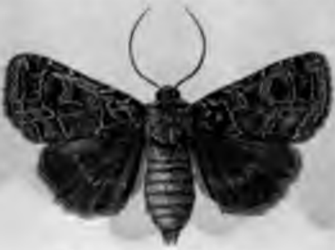


Fig. 161.—The Gothic.

The caterpillar is smooth and velvety, of a dull brown or greenish colour, with darker dorsal and side stripes. The latter are crossed obliquely by a series of whitish lines. It feeds on fruit and other trees in clusters when very young in early autumn, and afterwards descends and feeds on low plants. It hybernates in the winter, and feeds again on low plants in the spring. When full grown it burrows into the soil to undergo its changes.

The Old Lady (Mania Maura)

This fine moth is so very different from the last in appearance that the reason for placing the two in the same genus is not apparent till the earlier stages and life history have been studied. All its wings are very deep brown; the front pair has a darker band containing the orbicular and reniform spots, and the hind pair a lighter band across the middle.

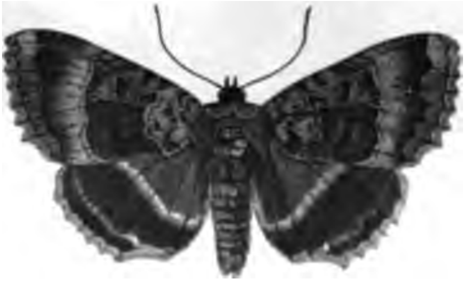


Fig. 162.—The Old Lady.

It is a common moth, often to be found at rest by day in outhouses and sheds. It flies in July and August.

The caterpillar is dark purple or umber brown, with darker and lighter markings. It feeds in the autumn on fruit trees, and hybernates during the winter. In the spring it feeds again on low plants, and changes to a chrysalis in May under the ground.

Family—Orthosiidæ

This is a large family of over thirty species, most of them of rather small size, which make their appearance, with two exceptions, either in early spring or in late autumn, often attracted in the former season by the sallow blossom, and in the latter by ivy bloom.

Several of them are very common insects, that are almost sure to be taken by a young collector during his first season.

The fore wings of these moths are more or less pointed at the tip, and the usual lines and spots are generally distinct. The males may be distinguished from the females by their antennæ, which are always more or less ciliated.

The caterpillars are smooth and velvety, and feed by night; and the pupæ are inclosed in cocoons constructed of earth and silk.

The Common Quaker (*Tæniocampa stabilis*)

Several of the species of the family are known popularly as Quakers, the commonest of which—*Stabilis*—is abundant in all parts.

Its fore wings are grey, with generally either an ochreous or reddish tinge. The orbicular and reniform spots are outlined with a paler colour, and there is a pale transverse line parallel with the hind margin, outside which is a row of indistinct black spots. The hind wings are greyish brown.

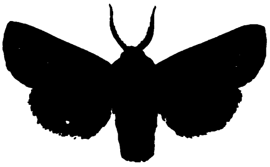


Fig. 163.—The Common Quaker.

The caterpillar is green and velvety, with a yellowish line on the back and on each side; and a yellow band crosses the back of the twelfth segment transversely. It feeds during June and July on oak (*Quercus Robur*) and elm (*Ulmus campestris*), and changes to a chrysalis in August on the surface of the ground. In this state it remains throughout the winter, and the moth emerges in March or April.

The Chestnut (*Cerastis Vaccinii*)

Unfortunately our space will not allow us to notice the whole of even the very common moths, so, passing over a few with great reluctance, we come to the familiar Chestnut, which may be seen at large in October and November, and sometimes even in December, and again appears, after a rather short period of hybernation, in February and March.

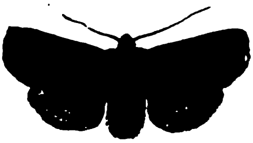


FIG. 164.—THE CHESTNUT.

The fore wings are reddish brown, with darker wavy lines. The orbicular and reniform spots have pale outlines, and the lower half of the latter is very dark grey. The hind wings are smoky grey, with generally a pale band beyond the middle.

The caterpillar is dark brown, with very indistinct lighter lines The spiracles are black, and inclosed in a yellowish grey stripe. It feeds during June and July on the elm (*Ulmus campestris*), oak (*Quercus Robur*), and sallow (*Salix caprea*), and various low plants.

The Pink-barred Sallow (*Xanthia Flavago*)

This moth is not nearly so common as the preceding species, but has been taken more or less in all parts of England.

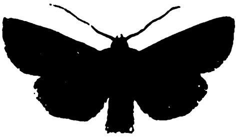


FIG. 165. THE PINK-BARRED SALLOW.

Its fore wings are orange yellow, with purplish markings arranged as represented in fig. 165. The hind wings are yellowish white.

The caterpillar is brown, with a lateral stripe formed by numerous red, yellow and white dots. It feeds on sallow (*Salix caprea*) and various low plants.

It is full grown in June, and the moth appears in September.

Family—COSMIIDÆ

The Dun-bar (*Calymnia trapezina*)

Our example of this family is the Dun-bar, common everywhere during July and August.

Its fore wings are greyish ochreous, with a darker band across the middle. On each side of this band is a white line margined with dark grey, and there is a row of black spots along the hind margin. The hind wings are smoky brown, becoming paler towards the base.

The caterpillar feeds on oak (*Quercus Robur*), hornbeam (*Carpinus Betulus*), and birch (*Betula alba*), and may be found in abundance during May and June. It is green, with dark spots, and white lines on the back and sides. Although it partakes of the leaves of the above-named trees, yet its chief food seems to be other caterpillars, for it devours these with a savage greediness that is simply astonishing. It will chase an unfortunate caterpillar, seize it by the neck with a fatal grip, and rapidly devour it. Its chief prey seems to be the larva of the Winter Moth (*Brumata*).

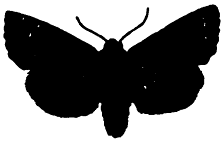


FIG. 166.—THE DUNBAR.

Family—HADENIDÆ

Nearly fifty British *Noctuæ* are included in the family *Hadenidæ*. They are of variable dimensions, and differ much in the brightness of their colours, some being very dingy, and others gaily tinted. Their antennæ are rather long; and when at rest the wings slope from the back like the sides of a roof.

The larvæ are smooth, and not very thick; and there is sometimes a hump on the twelfth segment. The pupæ are brown and shiny, and are inclosed in earthen cocoons beneath the surface of the soil.

The Broad-barred White (*Hecatera serena*)

Although not gaily coloured, this is a pretty little moth, there being a bright contrast between the white ground and the grey markings of the wings. It is common in the south of England, and seems to be plentiful in and around London.

The caterpillar is of a dingy greenish colour, with a yellowish stripe on each side of the back; and there are two distinct dots on the back of each segment. It feeds during July and August on sow-thistles (*Sonchus oleraceus* and *S. arvensis*), sleepwort (*Lactuca virosa*), and hawkweeds (*Hieracia*).

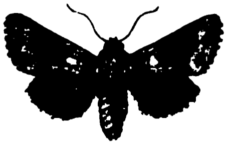


FIG. 167.—THE BROAD-BARRED WHITE.

The moth flies in June and July.

The Marvel-du-jour (Agriopis Aprilina)

The Marvel-du-jour is decidedly a beautiful moth—quite an exception among the *Noctuæ* in this respect, and it is withal both common and widely distributed. We need not describe it, since it is represented on Plate XI (fig. 2), and can hardly be mistaken for any other species.

The caterpillar is dull green, often tinged with red. The dorsal line is broad and dark, and interrupted by a series of very light lozenge-shaped spots. It feeds on the oak in May and June, and is full grown in the latter month. It then burrows into the earth at the foot of the tree, and there constructs a fragile earthen cocoon previous to changing to a chrysalis.

From July to September the chrysalides may be obtained in plenty by breaking up the sods at the roots of oaks, and the perfect insect may be found toward the end of September and throughout October.

The Small Angle Shades (Euplexia lucipara)

This pretty little moth is represented in fig. 3 of Plate XI. It is very common throughout the country, and may be seen in June and July.

The caterpillar is thickest on the twelfth segment, and gradually tapers from this towards the head. Its colour is pale green, with a white stripe just below the spiracles, which are black. On each side of the back are a number of oblique lines, which meet in the middle line, thus forming a series of V-shaped marks pointing towards the tail. It feeds on the common bracken fern (*Pteris aquilina*), foxglove (*Digitalis purpurea*), and the male fern (*Lastrea Filix-mas*), in August and September.

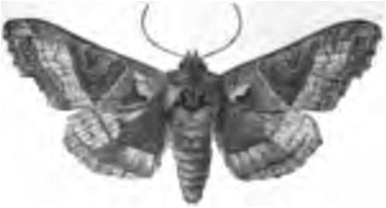


Fig. [illegible].—The Angle Shades.

The Angle Shades (Phlogophora Meticulosa)

This moth is so common and so widely distributed that it is almost sure to be taken by the young collector during his first season. Its wings are [illegible] light ochreous, often [illegible] pink or olive green, and marked with dark brown as shown in the illustration. It is double brooded, the first brood appearing in May and June, and the second in September and October.

The caterpillar is green or olive brown, and thickly covered with white spots. It feeds on groundsel (*Senecio vulgaris*) and many other low plants, the first brood throughout the winter from November to April, and the second in July and August.

The Grey Arches (*Aplecta nebulosa*)

The fore wings of this moth vary from greyish white to a rather dark smoky tint. The markings are of a darker colour, and are also subject to considerable variation. The orbicular and reniform spots are large, and paler than the ground colour; and several zigzag or scalloped lines, more or less distinct, cross the wings transversely.

The larva is brown, with a lighter line down the back. On each of the segments five to eleven is a dark lozenge-shaped spot, bisected by the dorsal line; and on the second segment is a shining plate and a triangular mark. It feeds on the dock (*Rumex*), and various other low plants during the autumn; and, after its hybernation, on the leaves of the sallow (*Salix Caprea*), birch (*Betula alba*), and whitethorn (*Cratægus oxyacantha*). It is full grown in May, when it burrows into the ground to undergo its metamorphoses.

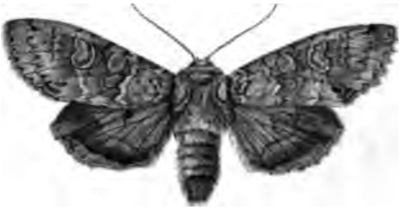


Fig. 169.—The Grey Arches.

The moth flies during June and July, and is common in nearly every part of Great Britain. Large numbers may be obtained by searching fences and tree trunks about midsummer.

The Shears (*Hadena dentina*)

The Shears is another very common moth of the same family. The ground colour of the fore wings is very variable, but is generally a lighter or darker shade of grey. Sometimes, however, it has a very decided brownish tinge. Across the centre of the wing is a darker band, wider on the costal side, containing the orbicular and reniform spots, as well as a light patch beneath them, and bordered on each side by a pale zigzag line. There is another similar line near to and parallel with the hind margin. The hind wings are smoky grey or smoky brown, darker towards the hind margin.

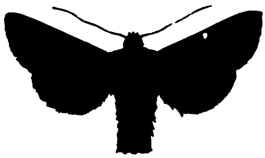


Fig. 170.—The Shears.

The caterpillar is greyish, and has a series of triangular black spots along each side of the back. It feeds on the roots of the dandelion (*Taraxacum officinale*), and changes to a peculiar spiny chrysalis.

The perfect insect appears to be abundant everywhere, and is on the wing in June and July.

The Bright-line Brown-eye (*Hadena oleracea*)

Every collector is sure to meet with this insect during his first season. The moth is abundant everywhere in June, the caterpillar may be found feeding in almost every waste and weedy spot in August and September, and the chrysalis is certain to be turned over by the pupa digger.

The fore wings of the perfect insect are reddish brown. The orbicular spot is usually very indistinct, being of almost exactly the same tint as the ground colour, and surrounded by a very fine whitish line. The reniform is generally more conspicuous, a portion of it being of a light ochreous colour. Near the hind margin, and parallel with it, is a white line, bent sharply into the form of a **W**, just on the anal side of the middle.

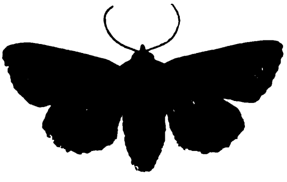


Fig. 171. The Bright-line Brown-eye.

The hind wings are greyish brown in the base, and dark smoke colour towards the margin.

The caterpillar is pale green or brown, dotted with both black and white, and adorned with a bright yellow line just below the spiracles. It feeds on the nettle (*Urtica dioica*), dock (*Rumex*), and many other low plants; and, according to some observers, on the elm (*Ulmus campestris*).

Family—Xylinidæ

The next family—*Xylinidæ*—contains twenty British species, several of which are local, but two or three are abundant and widely distributed.

The transverse lines that so often cross the wings of the *Noctuæ* are nearly or entirely absent in this family, and longitudinal lines take their place. When the insects are at rest the wings are folded rather closely, the outer pair being arranged like a roof with a very gentle slope. The bodies of the perfect insects are very stout, particularly in the thorax, and thus present a rather powerful appearance.

The larvæ are smooth, and generally brightly coloured, and feed principally on low plants. The chrysalides are generally inclosed in cocoons on or beneath the ground, and are often provided with spines or bristles on the under side.

We shall select two members of this family.

The Early Grey (*Xylocampa Areola*)

One of the first of the *Noctuæ* to greet us in the spring is the Early Grey, which may be found resting on fences in April, and, if the season is mild, in March.

Its fore wings are light grey, often tinged with rose pink, and marked with dark grey. The orbicular and reniform spots are very distinct, and surrounded by a pale line; they are both united at their lower edges. Along the hind margin is a series of dark spots. The hind wings are pale yellowish grey, with a darker central spot, a central transverse darker line, and a darker line along the hind margin.

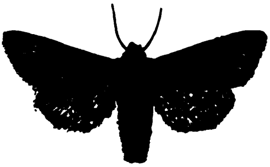


Fig. 172.—The Early Grey.

The caterpillar is yellowish grey. The dorsal line is lighter, and passes through a brownish spot on the eighth segment. It feeds on the honeysuckle (*Lonicera Periclymenum*) in July and August, being full grown towards the end of the latter month.

The Shark (*Cucullia umbratica*)

The Shark is a very common moth, to be found everywhere on palings in June, but the colour of its wings so closely resembles that of oak and other light-wood fences that detection is not so easy as with most other moths.

The fore wings are grey, and marked with longitudinal dark lines, the principal of which is a line from the middle of the base to about the centre of the wing. The wing rays are also darker than the ground colour. The hind wings are greyish white or brownish grey.

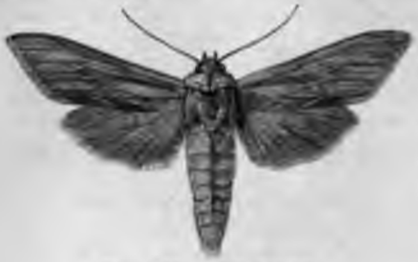


FIG. 173.—THE SHARK.

The caterpillar is very dark brown, with orange spots on the back and along the spiracles. It feeds on sow-thistles (*Sonchus oleraceus*, *S. palustris*, and *S. arvensis*) and sleepwort (*Lactuca virosa*) at night from July to September, and hides during the daytime among the leaves that lie close against the ground. When disturbed it does not roll into a ring or feign death like many others of its kind, but wriggles about most vigorously as if to repel its foe.

Family—GONOPTERIDÆ

The Herald Moth (*Gonoptera Libatrix*)

The above-mentioned family is so called on account of the angular margins of the wings, especially the fore pair. It contains only one British species, the Herald (Plate XII, fig. 1), a moth that is common everywhere in August and September. It hybernates in the perfect state, and the hybernated specimens may be seen in the spring time, from March up to the end of May or the beginning of June.

Its fore wings are reddish grey, thickly spotted and streaked with brown. Transverse whitish lines divide the base into three parts of nearly equal widths. The basal and central divisions are tinged with orange, and there is a small white spot in the base close to the thorax, and another near the centre of the wing. The hind wings are brownish grey.

The caterpillar is green and velvety, with a whitish stripe on the side, and yellow spiracles. It feeds on willow (*Salix alba*) and sallow (*Salix caprea*); and when full grown, about the end of June, it spins a white silken cocoon between leaves of its tree, and changes to a very dark chrysalis.

Family—PLUSIIDÆ

The most peculiar feature of the moths of this family is the tufts of hair that stand up perpendicularly on the top of the thorax. The abdomen also is crested, and the fore wings of several species have smooth patches that display a brilliant metallic lustre.

Most of the larvæ may be described as semi-loopers, for their claspers number only three pairs, and when they walk their backs are considerably humped, somewhat after the fashion of the *Geometræ*. Some of them further imitate the *Geometræ* in their position of rest, holding on by their claspers only, with body straightened out at an angle with the leaf or twig on which they support themselves.

Unlike the majority of the *Noctuæ*, they do not descend to the ground when about to change, but spin a silken cocoon among the food plants.

The Burnished Brass (*Plusia Chrysitis*)

One of the commonest of the *Plusiidæ* is the Burnished Brass, so called on account of the large patches of bright golden green on the fore wings. The hind margin of these wings is very gracefully curved, and bordered with brown. A brown blotch fills the base of the wing, and the remaining area is of a beautiful metallic greenish yellow, broken by two large brown blotches, one on the costal and the other on the inner margin, which closely approach each other and sometimes meet.

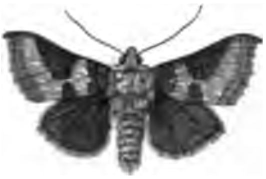


FIG. 174.—THE BURNISHED BRASS.

This moth is very common everywhere, and is one of the frequent visitors to our flower gardens from June to August.

The caterpillar is thickest at the twelfth segment, and tapers from this point. Its colour is pale green. It has no longitudinal stripes on the back, but each segment is adorned with four or six oblique white marks. Just above the spiracles is a white stripe. It feeds on the dead nettle (*Lamium album*), stinging nettle (*Urtica dioica*), and burdock (*Arctium minus*), and is full grown in June.

The Silver Y (*Plusia Gamma*)

Our second example of this family is the Silver Y, which may be found in abundance everywhere from June to October. Its fore wings are of a shiny grey colour, beautifully marbled with a rich dark brown; and just below the orbicular spot is a brilliant silvery spot, in form something like the Greek letter γ placed obliquely. The base of the hind wings is grey; along the margin is a broad and dark smoky brown band, and the fringe is very light grey, barred with the dark tint of the band. This moth is commonly driven out of its hiding places among low plants as we walk in waste places, and when thus disturbed it takes a short and rapid flight, generally disappearing so suddenly among the herbage that it is difficult to locate it correctly.

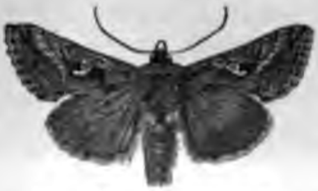


FIG. 175.—THE SILVER Y.

The caterpillar is thickest at the twelfth segment, and tapers gradually from this point towards the head. Its body is green, with several thin longitudinal white stripes, and a thin yellow stripe along the spiracles. It may be found from June to October, feeding on many kinds of low plants.

Family—EUCLIDIIDÆ

The Mother Shipton (*Euclidia Mi*)

Passing over a few small and less important families, we come to the *Euclidiidæ*, which contains only two British moths. One of these is the Mother Shipton, a very common insect that flies in June.

The fore wings of this species are very dark brown with whitish markings. The latter include a peculiarly tortuous line, the character of which will be made out more easily from our illustration (Plate XL. fig. 4) than from a written description. The hind wings are also very dark brown, and rather prettily spotted with an ochreous tint.

The caterpillar is pale grey, with four white stripes, and has only three pairs of claspers. It feeds in May on clovers (*Trifolium pratense* and *T. repens*) and other plants.

Family—CATOCALIDÆ

This family contains only four British species, but these few are very striking moths. They are of large size; and, unlike the *Noctuæ* generally, the chief adornment is reserved for the under wings. When at rest, the outer or fore wings completely hide the other pair, and then their general appearance is dull, though if closely examined it will be observed that these outer wings are really beautifully marbled with shades of grey.

The caterpillars of this family are very peculiar creatures. Their bodies are convex above and flattened beneath; and if disturbed as they rest on the bark of a tree, instead of leaving their hold and rolling into a ring like so many other larvæ of *Noctuæ*, they apply themselves the closer, and hold on as if to defy our attempts to remove them. Another peculiarity of these larvæ is the possession of fleshy projections along the sides, just above the legs. They feed on the leaves of trees, and when about to rest they descend to the trunk, and there remain protected by their imitative colouring, detection being rendered even more difficult by the close application of their flattened under surface to the bark. Before changing to the chrysalis state, they spin a light cocoon among the leaves or on the bark.

The Clifden Nonpareil (*Catocala Fraxini*)

This is the largest of the family, and, indeed, of all British *Noctuæ*. The fore wings and thorax are light grey, dotted and marbled with darker grey (see fig. 5, Plate XI); and the thorax and abdomen are banded with black and greyish blue.

The young entomologist can hardly expect to meet with this fine insect, for it is very rare, and it is only occasionally that a specimen is seen in Britain; but its characteristics are so striking that we have endeavoured to find it a place here. Reputed British specimens of *Fraxini* command the price of a few pounds each, but specimens from the other side of the Channel may be obtained for a few pence. With such rarities we should advise a young entomologist to purchase the foreign specimen rather than adopt the two other alternatives—give an exorbitant price for a supposed Britisher, or else remain a stranger to the gem, but all foreign specimens should be labelled according to their nationalities.

The Red Underwing (Catocala Nupta)

The other three members of the family are very similar in appearance, the fore wings of all being marbled with shades of grey, relieved by touches of black and brown; and the hind wings, red or crimson, give the popular names to the species.

The Red Underwing flies in August and September, and is common in the southern counties of England, as well as in some of the midland counties; it may be often seen flying by day around willows.

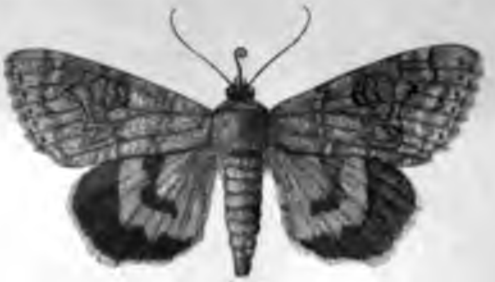


FIG. 176.—THE RED UNDERWING.

The caterpillar is similar in form to that of *Fraxini*, and when at rest by day on the bark of its tree it is very difficult to detect, so closely does it apply itself to the surface, and so perfectly does it imitate the colour of its surroundings. It feeds on the crack willow (*Salix fragilis*), sallow (*S. alba*), poplar (*Populus*), and plum (*Prunus*), and is full grown in June.

The Dark Crimson Underwing (Catocala Sponsa)

This beautiful insect is represented on Plate XI (fig. 6). It will be observed that the black band crossing the centre of the hind wing is rather broad and sharply bent—an important feature, since it is the most serviceable distinguishing mark between this species and the Light Crimson Underwing (*C. Promissa*).

The caterpillar is similar in form and habits to those of *Fraxini* and *Nupta*, and feeds on the oak. It is full fed about the beginning of June, when it changes to a chrysalis between leaves which it has spun together with silk.

The moth flies in July and August, and is common only in certain oak woods of the southern counties. It is particularly abundant in the New Forest, where scores may be taken in a single night by judicious sugaring.

There yet remain a few small families of the *Noctuæ*, but we must leave them in order that we may give a proportionate share of our space to the other great division of the larger moths—the *Geometræ*.

CHAPTER XX

GEOMETRÆ

have already referred (page 28) to caterpillars that walk by a series of strides, alternately looping and extending their long and slender bodies. It is this peculiar characteristic of the larvæ of the present division that suggested the name *Geometræ*—a term that signifies 'earth-measurers,' for they appear to measure the ground over which they travel in terms of their own length. We have also dealt with the peculiarities of structure in the case of these caterpillars— peculiarities which adapt them to this mode of progression; and we have now to make a selection from the various families of this important division for a more detailed description.

The *Geometræ* include nearly three hundred species and sixteen families. The moths have slender bodies and full wings, and generally rest with the latter outspread. A few, however, repose with wings erect like the butterflies, and a small number conceal their hind wings after the manner of the *Noctuæ*.

Family—UROPTERYGIDÆ

The Swallow Tail (*Uropteryx sambucaria*)

Our first family—*Uropterygidæ*—has only one British representative, and that is the well-known Swallow Tail, so common in gardens and among hedgerows in the south of England. This species is shown on Plate XII (fig. 2), and the insect is so readily identified by the conspicuous 'tails' on the hind wings that no written description will be necessary.

The caterpillar is a most peculiar and interesting creature. Its colour is very variable, being either brown, olive, ochreous, or reddish; and it is notched or humped in such a manner that it exactly resembles a twig. This strange imitation is rendered still more remarkable by the attitude assumed by the caterpillar when at rest. It fixes itself to a twig by means of its two pairs of claspers, with its body standing out at an angle in a perfectly straight posture; but its head is always supported by means of a very slender and almost invisible silk fibre. It feeds on a number of plants and trees, including elder (*Sambucus nigra*), blackthorn (*Prunus spinosa*), whitethorn (*Cratægus oxyacantha*), bramble (*Rubus fruticosus*), honeysuckle (*Lonicera Periclymenum*), and forget-me-not (*Myosotis arvensis*). It may be found feeding in the autumn, or hybernating in the crevices of the bark of trees in winter. In April or May it comes out again; and in June, in which month it is full grown, it binds together some fragments of leaves, and forms them into a little swinging hammock in which it changes to a brown chrysalis spotted with black.

Just at this time it seems to be particularly sensitive. In the caterpillar state it will strongly resent any kind of disturbance, and will give a blow to an intruder by suddenly swaying its body right and left; and while in its hammock a gentle irritation, such as a puff of wind from the mouth, will set it wriggling in a furious manner.

Family—ENNOMIDÆ

This family contains about twenty species, several of which rank among the commonest as well as the most beautiful of the *Geometræ*. Their wings are more or less angulated; and the antennæ are generally pectinated in the males.

The larvæ are generally humped and twig-like; and, as in the last species, the semblance is increased by the position they assume when at rest. The number of limbs varies from ten to fourteen, but where the claspers exceed two pairs, the additional two or four, as the case may be, are seldom used in walking.

The Brimstone Moth (*Rumia luteolata*)

As soon as the warm evenings of May set in, this lively and bright little moth may be seen flitting about among our hedges at sunset; and it continues with us throughout the whole of the summer, but is particularly plentiful during the month of June.

The moth itself need not be described, since it is shown on Plate XII (fig. 3); but the caterpillar (fig. 25) must receive a passing notice. It varies considerably in colour, being either green, brown, or marbled with a mixture of shades of both these colours. It has a hump on the back of the seventh segment, and two more on the ninth, and possesses four pairs of claspers. It feeds on whitethorn (*Cratægus oxyacantha*), blackthorn (*Prunus spinosa*), and the apple (*Pyrus Malus*), and may be found on these trees throughout the summer.

Some believe that there are three successive broods of this insect each year, but it is doubtful whether this is invariably the rule, since both the moth and its larva are to be found without intermission throughout the season.

The Light Emerald (*Metrocampa margaritaria*)

All the wings of this moth are very pale green, and crossed with a white band which is bordered with a darker green on the inner side. The fore wings have an additional transverse line just halfway between the former and the base, but this one is not so distinct. It flies in July, and is very widely distributed, and in some parts is very abundant.

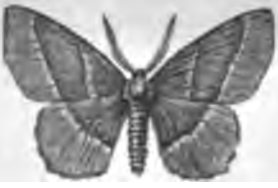


FIG. 177.—THE LIGHT EMERALD.

The caterpillar feeds in September, and again in May, after hybernation, on several of our forest trees, including the oak (*Quercus Robur*), elm (*Ulmus campestris*), birch (*Betula alba*), and beech (*Fagus sylvatica*). It is of a dingy olive colour, with a dark dorsal line, on each side of which is a row of white spots; and it has three pairs of claspers.

The Scalloped Oak (*Crocallis elinguaria*)

This species is common and widely distributed, and may be seen flying at dusk towards the end of July and throughout August. It is represented in fig. 4 of Plate XII. The antennæ of the male are strongly pectinated; those of the female are simple.

The caterpillar may be found in the autumn, and again in spring, feeding on the honeysuckle (*Lonicera Periclymenum*), whitethorn (*Cratægus oxyacantha*), blackthorn (*Prunus spinosa*), [illegible], and various fruit trees. It is full grown [illegible] turns to a chrysalis in a cocoon spun between leaves [illegible] the ground. It is of a greyish-brown or [illegible] colour, and looks very like a piece of twig.

The August Thorn (*Eugonia quercinaria*)

Our last example of this family is the August Thorn, represented in the accompanying woodcut. The fore wings are ochreous yellow, crossed by two nearly parallel lines of dark brown. In order to distinguish between this and one or two similar species it must be observed that both these lines are angulated near the costa, the inner one very sharply so; and between the two is a distinct brown spot near the costal margin. The hind wings are paler, and are crossed by an indistinct darker line. The antennæ of the male are strongly fringed; those of the female are simple.

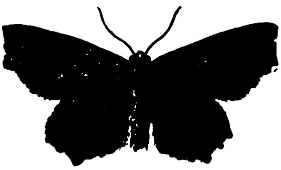


Fig. 178.—The August Thorn.

The moth is very common in August and September, and is readily attracted by lights in the evening.

The larva is grey, marbled with reddish brown. It has three small humps on each of the sixth and seventh segments, two on the twelfth, and one larger one on the ninth. It feeds on the oak and various other trees during the month of June.

Family—Amphidasydæ

The seven British species of the family *Amphidasydæ* are generally to be distinguished by their rather stout abdomens, and the long shaggy hair that covers their thoraces. The antennæ of the males are pectinated, and those of the females simple; and in three cases the latter sex is wingless.

The caterpillars have long and slender twig-like bodies, and are never provided with more than two pairs of claspers. The chrysalides terminate behind in a sharp spine, and are always to be found buried in the soil.

The Brindled Beauty (*Biston hirtaria*)

Early in April, and sometimes in March, this moth may be seen in abundance, resting on the lime trees in and around our towns. In fact, so strongly marked is its partiality to the haunts of man in the neighbourhood of our great metropolis that it has received the name of the Cockney. The male is represented in fig. 5 of

Plate XII, and the female may be distinguished from it by her simple antennæ and larger body.

The caterpillar is coloured with alternate bands of dark purple brown and reddish brown. There is a yellow band on the front of the second segment, a row of yellow spots on each side, and two little bright yellow warts on the back of each segment. It feeds by night on lime (*Tilia vulgaris*), elm (*Ulmus campestris*), and various fruit trees, and often appears in such numbers that the foliage is almost completely devoured. During the daytime it may be seen resting on the bark, almost invariably fixed longitudinally on the trunk, where it looks like a natural ridge of the bark which it so closely resembles in colour. It may be found in June and July, and in August it changes to a chrysalis at the foot of its tree, just below the surface of the soil.

The Peppered Moth (Amphidasys betularia)

Although this common species displays no bright tints, yet it is prettily marked, its whitish wings being peppered and blotched all over with black or very dark brown. It flies in May and June, later than any other species of the family, and may generally be found on fences and tree trunks during the day.

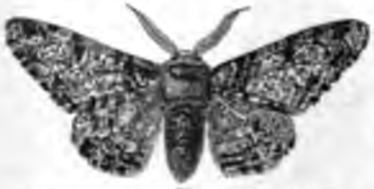


FIG. 179.—THE PEPPERED MOTH.

The colour of the caterpillar is very variable—drab, grey, green, or brown; but it may be known by the deep notch in the middle of the head, and the arrangement of its 'humps.' These latter are only small reddish or whitish projections, of which there is one on each side of the fifth, sixth, seventh, eighth, tenth, and eleventh segments; also two on the back of the ninth and twelfth. It feeds in August and September on a large number of trees, including, in fact, nearly all our commonest forest and fruit trees. In September it enters the soil to undergo its change to the chrysalis.

Family—BOARMIDÆ

In the next family—*Boarmidæ*—there are about twenty British members, most of which are very pretty moths. They differ generally from the last family in that their bodies are more slender, and although some of them bear a resemblance to species of the family *Ennomidæ*, their wings are not angulated. In several cases the fore and hind wings are both similarly marked, a feature very uncommon with moths.

The caterpillars of this family usually have humps on the sixth and twelfth segments only, and have two pairs of claspers. The pupæ are to be found either on the ground, among leaves or moss, or beneath the soil.

The Waved Umber (*Hemerophila abruptaria*)

The most gaily coloured member of this family is the Waved Umber, shown in fig. 6 of Plate XII. Like many other *Geometræ*, it rests on fences and tree trunks by day with wings expanded so that all four are displayed. It is on the wing in May and early June, and again in August, and often frequents our gardens at dusk.

The caterpillar is very dark brown, with a white collar on the front of the second segment. It feeds in June and July on privet (*Ligustrum vulgare*) and the cultivated rose trees of flower gardens, and probably also on the dog rose (*Rosa canina*). When full grown it spins a silken cocoon in a fork of one of the twigs, and there undergoes its metamorphoses.

The Willow Beauty (*Boarmia gemmaria*)

Our second example of the *Boarmiidæ* is the Willow Beauty, the male of which species is here illustrated. Its wings are brownish grey, marked with dark brown lines and streaks. The female is generally larger than the male, and has simple antennæ. The moth is abundant throughout England, and may be seen generally resting on fences and trees in June and July.

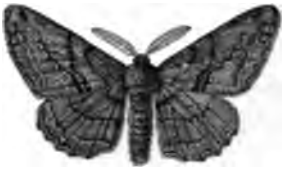


Fig. 180.—The Willow Beauty.

The ground colour of the caterpillar is much the same as that of the moth, and is marked with a similar darker tint. It has a yellowish line along the spiracles, and is much like a piece of brownish twig. It feeds on the oak (*Quercus Robur*), Birch (*Betula alba*), ivy (*Hedera Helix*), and other trees, and may be found in September and October.

Family—GEOMETRIDÆ

The next family contains eight moths, mostly of small size, all of which have green wings, and are popularly known as the 'Emeralds.' In most cases the male may be distinguished by its pectinated antennæ.

There is no general characteristic by which we may know all the larvæ, but some have the head deeply notched.

The Large Emerald (Geometra papilionaria)

This species is the largest of the family, and measures over two inches when its wings are expanded. The colour is dull green, with whitish bands and spots, the arrangement of which may be seen in our engraving.

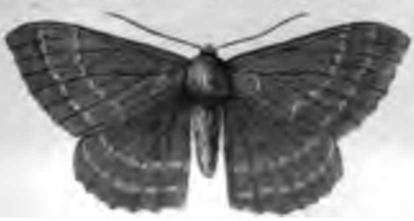


FIG. 181.—THE LARGE EMERALD.

The moth is out in July, and is common in most parts of England.

The caterpillar feeds on birch (*Betula alba*), beech (*Fagus sylvatica*) and hazel (*Corylus avellana*) in the autumn, and hybernates while still young. In the spring it feeds again, and is full grown in June, when it changes to a chrysalis in a cocoon spun between leaves.

The Common Emerald (Hemithea strigata)

One of the commonest of the Emeralds is *Strigata*, which may be found in June and July in all parts of England, as well as in some localities in Scotland and Ireland. Its wings are of a dull green colour, the front pair being slightly scalloped on the hind margin, and crossed by indistinct pale lines; and the hind pair are both scalloped and angled and crossed in the middle by a transverse pale line. The fringe is white, dotted with dull reddish brown.

FIG. 182. THE COMMON EMERALD.

The caterpillar is yellowish green, except the second, third, and fourth segments which are brownish. It feeds on oak (*Quercus Robur*) and whitethorn (*Crataegus oxyacantha*), and may be found in June.

Family—EPHYRIDÆ

The Maiden's Blush (*Zonosoma punctaria*)

The family *Ephyridæ* contains only six British species, chiefly remarkable for the fact that their pupæ generally resemble those of butterflies.

We choose for our example the pretty little Maiden's Blush, so called on account of the soft reddish patch on the middle of each fore wing. It is represented in fig. 7 of Plate XII. It is moderately common, occurring more or less in all parts of England, as well as certain localities in the sister countries. It is a double-brooded moth, and may be caught in May and August.

The caterpillar feeds on oak (*Quercus Robur*), from which it may be obtained by beating both in June and September. It is either green or tawny yellow, marked with yellow oblique lines on the sides.

Family – ACIDALIIDÆ

The moths of this family, over thirty in number, are mostly of small size, and have slender bodies. As a rule the wings are not in the least angulated or scalloped, but in a few species the hind pair are slightly angled on the hind margin ; and both fore and hind wings are similarly marked. The antennæ are simple in the females, and generally only slightly ciliated in the males.

The caterpillars are long and slender, without projections, and feed principally on low plants. The pupæ are to be found in loose cocoons among the leaves of the food plants or under the soil.

We shall briefly notice three members of this rather extensive family.

The Lace Border (*Acidalia ornata*)

The wings of this moth are silvery white, marked along the hind margin with a beautiful lace-like border. This border consists of delicate black and dark grey lines, and includes, in the fore wing, two light brown blotches, one near the middle and the other in the anal angle. It is abundant in England, particularly in chalky districts, but does not seem to extend into Scotland. It may be seen on the wing from June to August.

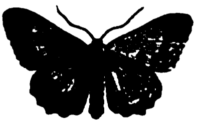


FIG. 183.—THE LACE BORDER.

The caterpillar feeds on thyme (*Thymus Serpyllum*) and marjoram (*Origanum vulgare*).

The Riband Wave (*A. aversata*)

All the wings of this species are of a pale yellowish or ochreous grey. The fore wings are crossed by three transverse dark lines, and the hind wings by two. The space between the two outer lines of the fore wing and that between the lines of the hind wing are usually filled in with a greyish brown, thus forming the 'riband' from which the popular name of the insect is derived; and when this is the case the lines which border the riband are scarcely distinguishable. Just inside the second line of the fore wings, near the costa, is a small but conspicuous brown spot.

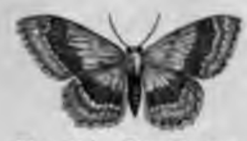


FIG. 184.—THE RIBAND WAVE.

The moth flies in June and July, and is common in all parts.

The caterpillar is dark brown except segments ten to thirteen, which are grey. The line along the spiracles is whitish, and the surface of the body is roughened by a number of minute warts. It feeds on various low plants, including the meadow sweet (*Spiræa ulmaria*), water avens (*Geum rivale*), common avens (*G. urbanum*), and knot-grass (*Polygonum aviculare*), during April and May.

The Blood-vein (*Timandra amataria*)

Our last example of the *Acidaliidæ* is the Blood-vein, which is common in most parts of England in June and July.

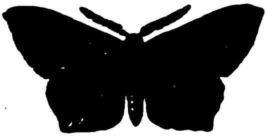


FIG. 185.—THE BLOOD-VEIN.

Its fore wings are pale grey, dusted with darker grey, and crossed by an oblique red streak which runs from the tip of the fore wing to near the inner margin of the hind wing. A slender dark and wavy line lies outside this one, parallel with it in the hind wing, but meeting it near the tip of the fore wing.

The caterpillar is grey, with three white longitudinal stripes. It feeds in the autumn on dock (*Rumex*), sorrel (*R. acetosa*), and knot-grass (*Polygonum aviculare*).

Family CABERIDÆ

Six species, all of rather small size, constitute the British portion of the above family. Their wings are mostly white or pale grey, with light markings, and without angles. The moths are to be caught with the net at dusk, or they may be seen on fences and tree trunks during the day, with their wings fully extended and applied closely to the surface on which they rest.

The larvæ, which have no humps, feed on trees, and change to the chrysalis state in light silken cocoons.

The Common Wave (*Cabera exanthemata*)

The first of our two examples of this small family is the Common Wave, the wings of which are pale grey, almost white, dusted all over with small dark dots. The fore wings are crossed by three parallel and equidistant darker transverse lines, and the hind pair by two. The male may be distinguished by its ciliated antennæ.

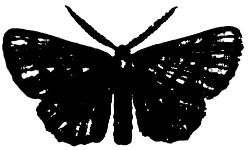


FIG. 186.—THE COMMON WAVE.

The caterpillar is yellow or greenish yellow, with hinder segments slightly swollen. It feeds during the latter part of the summer on sallows (*Salix caprea* and *S. cinerea*) and alder (*Alnus glutinosa*), and changes to a chrysalis in a light cocoon among fallen leaves. In this state it spends the winter, the perfect insect emerging in May or June.

This species is very abundant in most parts.

The Clouded Silver (*Bapta temerata*)

The other example is the Clouded Silver, the wings of which are white, and clouded along the hind margin with smoky grey. On the hind margin of the fore wings, close to the fringe, is a row of black crescent-shaped spots; and on the inner side of the cloudings is a waved transverse band. In the centre of the same wings there is a very distinct dark spot.

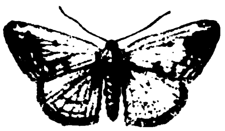


FIG. 187.—THE CLOUDED SILVER.

This moth is not so common as the last, but is widely distributed. It flies in May and June.

The caterpillar is bright green on the upper side, and has a row of orange spots, bordered with brown, down the middle of the back. It feeds in the autumn on the blackthorn (*Prunus spinosa*) and the wild cherry (*P. Avium*), and spends the winter in the chrysalis state, inclosed in a light silken cocoon.

Family—Macariidæ

The V *Moth (Halia Vauaria)*

The family *Macariidæ* contains only five British species, four of which have the tip of the fore wings extended more or less into an angle, and the hind wings are also angled to a greater or less extent.

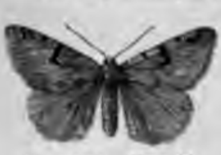


Fig. 188.—The V Moth.

Our only example is the V Moth, so called from the conspicuous V-shaped blackish mark on the middle of the costa of the fore wings. The ground colour of all the wings is grey, with a delicate violet tinge. There are other dark markings in addition to the one mentioned above, and the arrangement of these may be seen in the woodcut.

This species is very common in all parts, and flies at about midsummer.

The caterpillar is very variable in colour, but is generally green, and is marked with longitudinal wavy lines. On each side is a series of yellow blotches, forming a broken lateral stripe, and the body is covered with minute black bristle-bearing warts. It feeds in May on gooseberry and currant bushes, and changes to a chrysalis in a web between the leaves.

Family—Fidoniidæ

We now come to a family of moths peculiar for their habit of flying more or less by day. As is often the case with day-flying moths, these are mostly prettily marked, and are consequently often mistaken by the uninitiated for butterflies. Most of them are to be found on heaths, downs, and open fields; but one—the Bordered White—is met with only in fir woods.

The wings are not angulated, and the antennæ of the males are pectinated.

The larvæ are generally to be distinguished by a couple of little horns on one or more of the hindermost segments, and in most cases they pupate beneath the surface of the soil.

The Common Heath (Ematurga atomaria)

Of this family we shall select two examples, the first of which is the Common Heath, often so abundant on heaths and downs that they are disturbed at almost every footstep.

The ground colour of the wings of the male is a dull yellowish grey, and that of the female greyish white. In both cases the wings are crossed by irregular dark brown bands. The fringe is barred alternately with white and dark brown, and the whole of the ground tint between the above-mentioned bands is thickly dotted with dark brown. The female is generally smaller than the male.

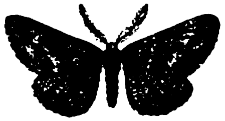


Fig. 189.—The Common Heath.

The caterpillar is very variable in colour, but is generally reddish brown, ochreous brown, or greenish, with a light line along the spiracles, and a series of lozenge-shaped spots on the back. It feeds on trefoils (*Lotus corniculatus* and *L. pilosus*) and various other plants that grow on heaths.

The Bordered White (*Bupalus piniaria*)

The male of this species is boldly marked with yellowish white and dark brown, the arrangement of the two colours being shown in fig. 190. The female is very different in general appearance. Her wings are of an almost uniform orange or yellowish-brown tint. The fore wings are darker near the tip, and there is generally a darker transverse band across the centre.

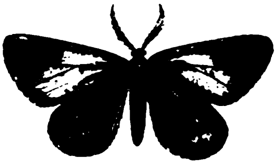


Fig. 190.—The Bordered White—Male.

The male may often be seen flying in the sunshine among the branches of fir trees during May and June, but his mate is rather less active, and is generally to be secured by beating the branches.

The caterpillar is pale green, with whitish stripes and yellow spiracles. It feeds during August and September on the leaves cf the Scotch fir (*Pinus sylvestris*).

Family—Zerenidæ

The Currant Moth (*Abraxas grossulariata*)

The family *Zerenidæ* contains only four British moths, and of these we select the Currant Moth or Magpie. This insect is exceedingly common everywhere, and on account of its general brightness of appearance, and also of its diurnal habits, it is often taken for a butterfly. The ground colour of the wings is creamy white, with a yellow transverse band, and a yellow blotch at the base; and the whole surface is more or less blotched with black.

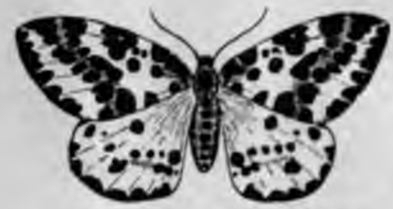


FIG. 191.—THE CURRANT MOTH.

From the end of June to August this moth may be seen in abundance in our gardens, wherever currant bushes exist, flying about both during the sunshine and at dusk, with rather a heavy movement.

The caterpillar is white, with a yellow line along the spiracles, and numerous black dots. There are, in addition to the dots, two large black blotches on the back of each segment. It feeds during May on currant and gooseberry bushes, also on the blackthorn (*Prunus spinosa*). About the end of May it spins a light silken cocoon, and changes to a short dumpy chrysalis of a glossy black colour with bright yellow bands (fig. 84).

Family—HYBERNIIDÆ

Passing over the family *Ligiidæ*, which contains only one British moth, the Horse-chestnut, we come to the small but interesting family, *Hyberniidæ*.

Of this we have six species, five of which favour us during the bleakest months of the year. Two of them visit us in October and November, and even remain with us up to Christmas. The others follow closely on them, and may be seen from January to March.

The males have slender bodies, and their wings are full and without angles; but the females are either perfectly or nearly wingless. In three cases there is hardly a trace of wings in this sex, so that they look more like spiders than moths.

The caterpillars are long and slender and without humps, and all feed on the leaves of trees. They change to the chrysalis state under the ground.

The Spring Usher (Hybernia leucophæaria)

Early in February, or often even in January, this moth may be seen in abundance in almost every oak wood, sitting on the bark of the trees, or occasionally taking a short flight in the sunshine. In colour it is very variable. The wings have always a whitish ground marbled and dotted with dark brown, but in some the fore wings are almost entirely dark brown with the exception of a transverse central bar. The female has only the slightest rudiments of wings.

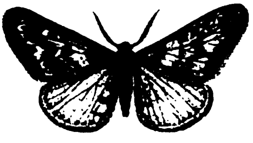


FIG. 192.—THE SPRING USHER.

The caterpillar feeds on the young buds and leaves of the oak (*Quercus Robur*) and sycamore (*Acer Pseudo-platanus*), concealing itself among the small leaves which it has spun together. It is full grown in June, when it changes to a chrysalis on the surface of the ground, and remains here throughout the summer and part of the following winter.

The colour of the caterpillar is very variable, but is usually pale green with white markings.

The Mottled Umber (*Hybernia defoliaria*)

This very pretty moth is represented in fig. 8 of Plate XII. It is very common in most parts, and visits us at the fall of the leaf, generally appearing in October, and remaining on the wing till November. Our illustration gives the usual appearance of the male, but in some specimens the four wings are all of one uniform reddish-brown colour, evenly dotted all over with a darker tint. The female is quite wingless.

The caterpillar is exceedingly pretty. Its head is large and brown. The back is brown, bordered with a fine black line. Below this is a broad and bright yellow line, with a red spot on each segment. The spiracles are white. It feeds during spring on oak (*Quercus Robur*), whitethorn (*Cratægus oxyacantha*), blackthorn (*Prunus spinosa*), and other trees. When disturbed it always allows itself to fall for a foot or two, and then remains swinging at the end of a silken fibre till danger is over, or hunger recalls it to its food. It changes to a chrysalis on the ground about the middle of June.

The March Moth (*Anisopteryx æscularia*)

This is another common moth, and should be looked for during March and April on the barks of trees in oak and other woods.

The fore wings are of a dingy brown colour, paler near the base, and crossed by a pale wavy line. The hind wings are lighter, with a central dark spot. But this description applies to the male only, for the female is wingless, and may be known by the tuft of hair that tips the abdomen.

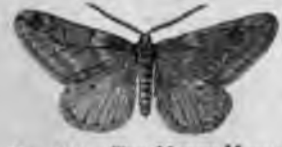


FIG. 193.—THE MARCH MOTH.

The caterpillar is pale green, clouded with a darker tint, and has a white line on each side of the back. It feeds in May on the three trees named for the last species, also on lime (*Tilia vulgaris*) and elm (*Ulmus campestris*).

Family—LARENTIIDÆ

This is by far the most extensive family of the *Geometræ*, containing as it does considerably over a hundred species, or well nigh a half of the whole group.

The wings of the various species are smooth and more or less glossy, and the front pair are generally crossed by several wavy lines. Many of the moths, and particularly those known popularly as the Pugs, are very small. Representatives of the family are to be met with almost throughout the year—from early spring to the middle of the winter.

Most of the caterpillars are rather long and slender, and without humps; and green is the prevailing colour. They feed either on trees or low plants, often protecting themselves in folded leaves; and some of the smaller species show a decided preference for flowers and seeds.

We shall select about a dozen of the commonest members for individual description.

The November Moth (*Oporabia dilutata*)

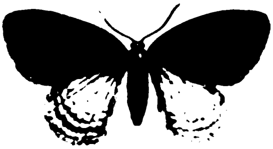


FIG. 194.—THE NOVEMBER MOTH.

Our first example is the November moth—a rather dingy and very variable species that may be found almost everywhere in October and November. The ground colour of the fore wings is dingy grey, crossed by several darker lines, subject to considerable variation. The hind wings are paler, with two slender darker lines parallel with the hind margin.

The caterpillar feeds on many trees, the principal of which are the oak, whitethorn and blackthorn. Like the perfect insect, it is very variable in colour, but is generally of a bright green, with reddish or purplish spots on the back and sides. The spiracles are yellow or orange, and below them is a white stripe. It is full fed in June.

The Twin-spot Carpet (*Larentia didymata*)

The Twin-spot Carpet is common throughout Great Britain, and the beginner is likely to meet with it in June and July during his first season. Our illustration represents the male, the fore wings of which are greyish brown, crossed by several dark lines, and with a double dark and conspicuous spot near the middle of the hind margin. The female is much lighter, and the markings are also lighter and less distinct.

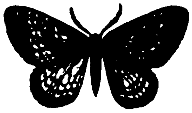


Fig. 195.—The Twin-spot Carpet.

The caterpillar is pale green, with a narrow whitish line along the spiracles. It feeds in April and May on the leaves of the wood anemone (*Anemone nemorosa*), chervil (*Chærophyllum temulum*), and other plants.

The Grass Rivulet (*Emmelesia albulata*)

We represent the genus *Emmelesia* by the Grass Rivulet—a pretty little moth that flies in June, and which is widely distributed though not abundant.

Its fore wings are pale grey, crossed by several white lines, the arrangement of which may be seen in our engraving. The hind wings are of the same ground colour, but have no markings except a white wavy line near the hind margin.

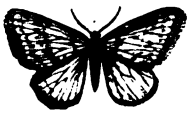


Fig. 196.—The Grass Rivulet.

The caterpillar feeds during July and August on the seeds of the yellow rattle (*Rhinanthus Crista-galli*), protecting itself from its enemies by spinning together the petals of the flowers; and when full grown it changes to a chrysalis under the same cover.

The Netted Pug (*Eupithecia venosata*)

We now come to the enormous genus *Eupithecia*, containing about fifty small species, most of which are known as 'Pugs.'

Many of these are only imperfectly known, there being yet much to learn about their earlier stages.

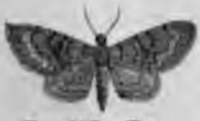


FIG. 197.—THE NETTED PUG.

The Netted Pug flies in May and June, and is to be found in most parts of Great Britain. Its fore wings are brownish grey, crossed by two zigzag light bands, both of which are bordered with black, and divided throughout by a fine dark line. There are also other dark lines, both transverse and longitudinal, arranged as here represented.

The caterpillar feeds during July inside the seed capsules of campions (*Silene Cucubalis*, *S. maritima*, *S. acaulis*, and *Lychnis diurna*) and catchfly (*Silene gallica* and *S. nutans*).

The Narrow-winged Pug (*Eupithecia nanata*)

FIG. 198.—THE NARROW-WINGED PUG.

Early in May, and frequently in April, this pretty little moth may be seen flying about at dusk among the heather on our moors. It is one of the first Pugs of the season, and is widely distributed, and very common in some localities.

Its wings are dark grey, and marked with several transverse wavy light lines. The fringe is dark grey, spotted with white.

The caterpillar feeds during August and September on the ling (*Calluna vulgaris*) and heath (*Erica cinerea* and *E. Tetralix*).

The Brindled Pug (*Eupithecia abbreviata*)

Our last example of the Pugs is the Brindled Pug, another early species, appearing on the wing in March and April. It is common in most parts, and may generally be easily obtained by searching fences and tree trunks.

FIG. 199.—THE BRINDLED PUG.

Its fore wings are very long in proportion. The colour is yellowish brown, crossed by darker lines. The fore wings have a very broad band of the ground colour, broken by two short lines, and crossed by a [illegible] serrated stripe.

The caterpillar feeds on the oak in June.

The Small Seraphim (*Lobophora sexalisata*)

This moth is very much like the Pugs in general appearance, and is quite as small and even smaller than some of them; but it and the other members of its genus differ from the Pugs in that they cover their hind wings when at rest.

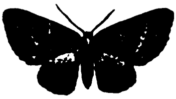


FIG. 200.—THE SMALL SERAPHIM.

The fore wings are yellowish or pale brownish grey with four paler transverse lines, the two median ones of which are divided throughout by a darker fine wavy line. The hind wings are grey, paler at the base, and crossed centrally by a double darker line. This species flies in May and June, and though apparently widely distributed, can hardly be described as common.

The caterpillar feeds on the white willow (*Salix alba*) and sallow (*S. caprea*) in August and September; and the chrysalis may be found in a silken cocoon among the fallen leaves throughout the winter.

The Blue-bordered Carpet (*Melanthia bicolorata*)

This same family (*Larentiidæ*) is remarkable for its large number of pretty moths, popularly known as the 'Carpets,' many of which are exceedingly common in our woods and gardens.

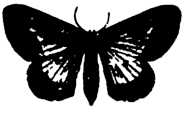


FIG. 201.—THE BLUE-BORDERED CARPET.

Our first example of these is the Blue-bordered, which is pretty well represented in several counties of Great Britain and Ireland. Its white fore wings are boldly marked with a blotch of greyish brown at the base, and another extending from the middle of the costal margin more than halfway across. The hind margin is marked with two bluish grey bars, separated by a white line. The hind wings are white, with a very small dark spot, and a bluish grey margin something like that of the fore wings.

The caterpillar is green, with longitudinal stripes of a darker and lighter shade. It feeds in June on the alder (*Alnus glutinosa*) and blackthorn (*Prunus spinosa*); and when full grown it changes to a brown chrysalis within a light silken web.

The moth flies in July and August.

The Beautiful Carpet (*Melanthia albicillata*)

The Beautiful Carpet belongs to the same genus as *Bicolorata*. Its wings are of a rich creamy white, clouded with grey along the hind margin. The basal blotches of the fore wings are large, of a dark brown colour, and marbled with a light tint. Near the tips of these wings is another conspicuous blotch of the same colour, from which a delicate wavy dark line runs to the inner margin. A small dark spot also lies near the middle of the costal margin of each of the four wings.

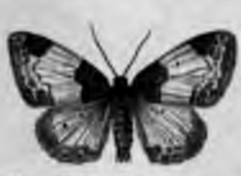


FIG. 202.—THE BEAUTIFUL CARPET.

The caterpillar is green, with a white line along the spiracles, and a triangular reddish spot on the back of segments four to ten inclusive. It feeds on the bramble (*Rubus fruticosus*), raspberry (*R. Idæus*), and wild strawberry (*Fragaria vesca*). It may be found in June and July.

The moth flies in June.

The Common Carpet (*Melanippe sociat*

The genus *Melanippe* contains twelve species, some of which are extremely common. One of these moths—the Common Carpet—is represented in fig. 203. Its wings are all of a smoky-brown colour, crossed by numerous white lines, the arrangement of which may be gathered from our illustration better than from a written description. It is a double-brooded insect, appearing first in May, and then again about the end of July.

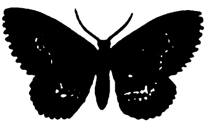


FIG. 203.—THE COMMON CARPET.

The caterpillar is mottled with shades of brown and grey. On the back are five or six greyish-white lozenge-shaped marks, and there are a few white dots on the back of each segment. It feeds on the hedge bedstraw (*Galium Mollugo*), and when full grown it changes to a chrysalis in a light cocoon on the ground.

The Silver Ground Carpet (*Melanippe montanata*)

In this species the ground colour is silvery white. The bases of the fore wings are blotched with pale brown, and a dark brownish-grey bar, containing a black spot, crosses the middle. The hind margins of the fore wings are faintly marked with pale brown, and lines of the same tint, more or less distinct, cross the hind wings.

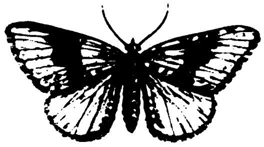


FIG. 204.—THE SILVER GROUND CARPET.

This moth is very common in all parts of the country, and may be seen on the wing throughout the summer.

The caterpillar is light brown, with several longitudinal lines of different colours. On the back of each of the segments seven, eight, and nine is a distinct black V-shaped mark, terminating behind with a bright red spot. It feeds on the primrose (*Primula acaulis*) in the autumn, hybernates through the winter, and is full grown about the beginning of April.

The Garden Carpet (*Melanippe fluctuata*)

Our third and last member of this genus is the Garden Carpet—a moth that must be pretty well known to almost everybody, since it is the commonest of all the *Geometræ* that frequent our gardens.

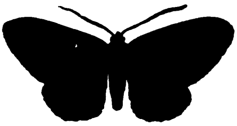


FIG. 205.—THE GARDEN CARPET.

The fore wings are pale grey or brownish, with a patch of dark greyish brown at the base, another larger one on the middle of the costa, and a third near the tip. The wing is usually clouded between the middle blotch and the inner margin, and numerous fine wavy lines, more or less distinct, cross the wing.

This moth may be seen throughout the summer, from May to September, but is most abundant in June and July.

The caterpillar is extremely variable in colour, being either green, brown, or grey, or some intermediate tint; and is marbled and dotted with dark brown on the back. It feeds on the nasturtium (*Tropæolum majus*), rape (*Brassica Napus*), and various other cruciferous plants; and may be found from April to August.

The Yellow Shell (*Camptogramma bilineata*)

Passing over two smaller genera, we come to the beautiful little Yellow Shell. This moth is so abundant in most parts that we arouse it at almost every stroke while beating low bushes.

All its wings are yellow, and crossed by numerous delicate white and brown lines. The most conspicuous feature is the two white lines, with dark brown edging, crossing the fore wings.

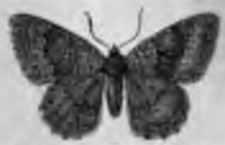


Fig. 206.—The Yellow Shell.

The caterpillar feeds by night, and is therefore seldom seen except by those who make special nocturnal searches with the aid of a lantern or sweep net. It devours various grasses, and hides itself among the roots or under stones during the daytime. It is full grown in April or May. The colour is dull pale green, with a dark green dorsal line, and two white stripes on each side.

The Small Phœnix (Cidaria silaceata)

Again passing over a few small and less important genera, we select the small Phœnix as the last example of this very extensive family.

The fore wings of this species are dark brown, paler toward the hind margin. Most of the wing rays are generally of a pale yellowish colour, and a variable and complicated system of whitish lines crosses the wings near the base, and another near the hind margin. Among the latter there is always a series of dark triangular spots, with apices pointing towards the hind margin.

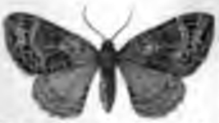


Fig. 207.—The Small Phœnix.

This moth is moderately common throughout the British Isles, and is double brooded, appearing in May and August.

The caterpillar is green, with a row of brown spots along the middle of the back. When full grown it changes to a chrysalis in a light web.

Family EUBOLIIDÆ

This is the last family of the *Geometræ* we shall notice, and contains ten species. Most of these are rather pretty moths, and all have the tips of the fore wings more or less pointed. As a rule, too, there is a dark streak running from the very tip of the wing for a short distance obliquely inward.

They are generally very light sleepers, and are easily beaten from their hiding places during the day.

The larvæ are not humped, and may be found feeding on low plants.

We shall briefly examine two species.

The Small Mallow (*Eubolia limitata*)

This moth is pretty abundant in waste places from June to August, and is easily obtained by lightly beating the foliage of small bushes and low plants.

Its fore wings are pale brown crossed by a broad central bar, the edges of which are darker. The hind wings are of a paler brown, and are crossed by two or three fine wavy lines.

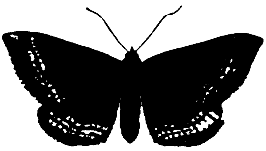


Fig. 208. The Small Mallow.

Although the perfect insect is so common, the caterpillar seems to be seldom met with. It is a grass feeder, and may be looked for in May and June.

The Treble Bar (*Anaitis plagiata*)

Our last example of the *Geometræ* is the Treble Bar, a very pretty moth, which is illustrated in fig. 9 of Plate XII. It may be readily identified by the aid of this coloured picture, and therefore need not be described in words. It is pretty generally distributed throughout the British Isles, and is in some parts a very abundant species, particularly so in the neighbourhood of London.

The caterpillar is brown, with paler spaces between the segments. The dorsal line is black and interrupted, and a yellow line runs along each side. It feeds on the leaves and flowers of the perforated St. John's wort (*Hypericum perforatum*).

This insect is double brooded, the moth appearing in May and August, and remaining with us throughout the month following in each case.

CHAPTER XXI

THE MICRO-LEPIDOPTERA

The butterflies, and all the moths contained in the groups of the last four chapters, are commonly spoken of as constituting the *Macro-lepidoptera*; but in addition to these there are many hundreds of small British moths that represent what is known as the *Micro-lepidoptera*.

It is not usual for young entomologists to have much to do with the 'Micros' until they have had a little practical experience with the larger species; in fact, a good number of them never seem to extend their knowledge beyond the limits of the 'Macros' except that they may make an occasional capture of a Micro that happens to fly across their path.

Now, since it would be practically impossible to deal fairly, even in outline, with both these divisions of the *Lepidoptera* in a work of the present dimensions, I have devoted most space to the larger species so as to meet the probable requirements of the majority of my readers. But in order that the beginner may also have the means of introducing himself intelligently to a study of the 'Micros,' I shall set apart this chapter for a simple account of the broad principles of their classification, illustrated by means of a few types, so that the collector may at least know *something* of the insects he captures, even though he may not be able at once to fix on their names.

The young entomologist, thus provided with the broad features that enable him to roughly classify the specimens which reach his cabinet, may, as his store increases, pay an occasional visit to a public museum or the private collection of an entomological friend, and so obtain the names and other details he may require.

The *Micro-lepidoptera* are divided into five main groups—*Pyralides*, *Pterophori*, *Crambi*, *Tortrices*, and *Tineæ*, each of which is divided into families and genera, as we have seen in the case of the 'Macros.'

Pyralides

The *Pyralides* may be easily distinguished by the proportionately long fore wings, long legs, and elongated abdomen. Some of them have wings of a pearly lustre, and are accordingly known popularly as the 'Pearls.' Some species fly in bright sunshine, others appear on the wing before sunset, and fly till dusk; others, again, are purely nocturnal in their habits. All, however, are apparently light sleepers, and may be easily beaten out of their resting places and netted by day. Some of these moths are common everywhere, but the majority of them are very local, though they may be extremely abundant where they occur.

The larvæ have a glossy and bristly appearance, and are generally gregarious in their habits.

This group contains about eighty species, arranged in five families as follows:

1. *Pyralididæ*, including about forty species.
2. *Botydæ*, about thirty species.
3. *Steniiadæ*, containing only five species.
4. *Hydrocampidæ*, four species.
5. *Acentropodidæ*, containing only one.

The Tabby (*Aglossa pinguinalis*)

The first of these families contains the Tabby or Grease Moth, commonly met with both in the larval and perfect states in barns and stables.

Its fore wings are brownish grey, crossed with zigzag darker lines, and having a black spot near the centre of the costal margin. The term 'Tabby' has been applied on account of the fancied resemblance of the transverse markings to the fur of a tabby cat, and the other popular name was given under the belief that the caterpillar feeds on fatty matter, but it is extremely doubtful whether this supposition is correct.

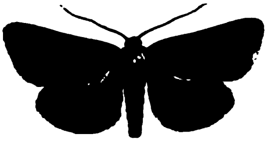


FIG. 209.—THE TABBY OR GREASE MOTH.

The caterpillar probably feeds exclusively on the vegetable accumulations that lie in the undisturbed corners and crevices of outhouses and stables, and lives concealed in silken tubes, strengthened outside by fragments of hay, chaff &c. that have been spun together. It feeds from September to April, except during very severe weather, and when full grown it leaves its tube, and changes to a chrysalis in a light silken cocoon in some secluded corner.

The moth emerges in July.

The Meal Moth (*Pyralis farinalis*)

The same family contains the common Meal Moth, so called because in the larval state it feeds on meal and allied substances.

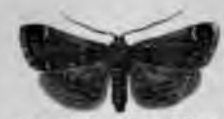


Fig. 210.—The Meal Moth.

The fore wings are yellowish grey, with reddish basal patches, a broad reddish band along the hind margin, and two whitish indented transverse lines. The hind wings are grey, and are crossed by two lines similar to and continuous with those of the front pair.

This moth is to be found in abundance throughout the summer months in places where corn, meal, and grain are stored in large quantities, sitting on walls and rafters during the daytime, and taking to flight in the evening.

The caterpillar feeds on corn, meal, grain, bran, &c., and lives concealed in a silken tube covered outside with particles of its food substance. It is not fully grown till nearly two years old, and then changes to a chrysalis in a white silken cocoon.

The Small Magpie (*Eurrhypara urticata*

The family *Botydæ* contains the moths that are popularly known as the 'Pearls' on account of the pearly lustre of the wings. One of its species—the Small Magpie—is shown in the accompanying illustration.

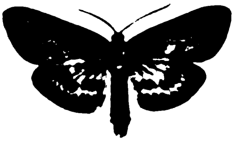


Fig. 211.—The Small Magpie.

Its fore wings are pearly white, with blackish hind margin, a yellow streak at the base, and blackish markings, the arrangement of which may be seen in the figure.

It is a very common moth, flying at dusk during June and July in waste places where the stinging nettle grows.

The caterpillar is whitish, with a dark dorsal line. It feeds on the stinging nettle (*Urtica dioica*), always remaining concealed between leaves which it has spun together with silken threads.

The Mother-of-Pearl (*Botys ruralis*)

This is another very common species of the family *Botydæ*, abundant almost everywhere, and to be found on the wing from June to August.

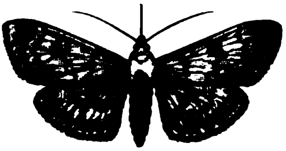


FIG. 212.—THE MOTHER-OF-PEARL.

Its wings are whitish, and exhibit a very decided pearly lustre, and all the markings are of a dull dark grey.

The caterpillar is glossy, and has a semi-transparent appearance. It is greenish white above, with a darker line down the back; and the sides are of a brighter green. It feeds on the stinging nettle (*Urtica dioica*) during May.

The Garden Pebble (*Pionea forficalis*)

The same family contains also the Garden Pebble, which is one of the commonest frequenters of gardens, both in town and country.

The fore wings are pale yellowish grey with brown markings. The latter include a fine line from the tip to the middle of the inner margin, and another paler one inside and parallel with this, having a dark spot near its centre. The hind wings are lighter, and have a pale and interrupted line parallel with the hind margin.

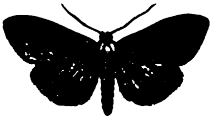


FIG. 213.—THE GARDEN PEBBLE.

The caterpillar is pale greenish, with a dark line along the back and on each side. It feeds on the cabbage and other cruciferous plants.

The moth flies from May to the end of the summer, and the caterpillar may be found about midsummer, and again in the autumn.

The Beautiful China Mark (*Hydrocampa stagnata*)

Our last example of the *Pyralides*—the Beautiful China Mark—belongs to the family *Hydrocampidæ*. This small family is remarkable for the fact that its four species spend their larval state in the water, feeding on the under surfaces of the leaves of water lilies and other aquatic plants. These curious larvæ live either in cases which they construct for their protection, something after the fashion of the larvæ of caddis flies, or quite free in the water, and then they are supplied with special breathing organs that enable them to absorb the oxygen held in solution in the water.

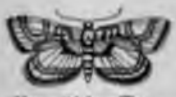


Fig. 214.—The Beautiful China Mark.

The moth we have selected for illustration is a very common species, and may be seen flying in great numbers in the neighbourhood of ponds during June and July.

The Pterophori

The members of this remarkable group are easily distinguishable from all other moths by the feathery appearance of their wings, a feature that has gained for them the popular name of *Plume Moths*. Their fore wings are more or less divided or cleft, and their hind wings are generally divided into three distinct feathery plumes.

The larvæ are hairy, and when full fed they suspend themselves by their anal claspers, and change to the chrysalis state without any kind of covering. They are generally to be found in spring and early summer, but some of them feed in the autumn.

The chrysalides are often hairy, though some of them are perfectly smooth.

Plume moths are to be met with more or less throughout the year. Many of the earlier species appear on the wing in spring and early summer; but the late feeders emerge in the autumn, and hybernate through the winter, often taking to the wing on the mild days of our coldest months.

The *Pterophori* include only about forty British species, all of which, with two exceptions, belong to the family *Pterophoridæ*. The two exceptions represent as many families—one the *Chrysocorididæ*, and the other the *Alucitidæ*.

Platyptilia gonodactyla

This [illegible] of the *Pterophoridæ*, generally appearing [illegible] towards the end of May [illegible] It starts from its retreat at [illegible] before sunset, and remains on the wing after dark.

Its fore wings are ochreous grey, with a narrow brown costal margin, and a triangular brown patch on the costa. Beyond this patch the wing is cleft. The hind wings consist of three distinct brownish plumes, the third of which has a small tuft of black scales projecting from the middle of the inner margin.

The caterpillar feeds on the flower stalks of the coltsfoot during March and April.

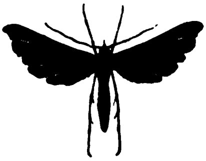


FIG. 215.—GONODACTYLA.

Leioptilus osteodactylus

This is another species of the same family. It is not uncommon, but is more local than the last.

Its fore wings are pale yellow, with a small brown dot at the commencement of the dividing fissure, and a brown blotch on the costal margin nearer the tip. The hind wings are divided into three distinct plumes like those of *Gonodactyla.*

This is a later species, appearing on the wing in July.

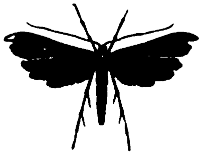


FIG. 216.—OSTEODACTYLUS.

Aciptilia pentadactyla

The fore wings of this species are white, frequently with a few greyish scales, and are deeply divided into two feathery plumes. The hind wings are pure white, and consist of three plumes.

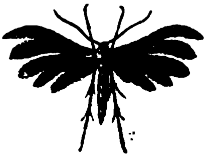


FIG. 217.—PENTADACTYLA.

This pretty insect is common and widely distributed, and flies during June and July.

The caterpillar feeds on the convolvulus in May.

Alucita hexadactyla

Our last example of the *Pterophori* is the Twelve plume Moth, the only British representative of the family *Alucitidæ.*

This little insect is of a yellowish colour, with two dark bands across the fore wings; and both fore and hind wings are divided into six distinct feathers. It is a common moth, and frequents sheltered spots, flying at dusk. It appears in August, remains on the wing till October, and then hybernates till the following April. During the winter it is commonly met with in outhouses and even in dwelling houses.

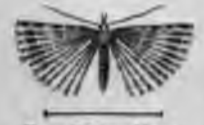


FIG. 218.—HEXADACTYLA—ENLARGED.

The caterpillar feeds during June and July on the flower buds of the honeysuckle (*Lonicera Periclymenum*). It is not hairy, like most of the larvæ of the last family; and, unlike these, it changes to a chrysalis in a silken cocoon.

Crambi

The third group of the 'Micros' is the *Crambi*, and contains about eighty species, arranged in four families.

Some of them are common moths with which all must be more or less familiar, as they are roused from the grasses on which they repose at almost every footstep as we walk through meadows in the summer. When at rest, they present a very peculiar appearance. Their wings are wrapped closely round their bodies in such a manner that they are hardly distinguishable from the stems on which they repose.

The larvæ have sixteen limbs, and are very variable in their habits. Some feed among moss or dry stems in silken tubes, some on the stems of reeds, and others inhabit the hives of bees and feed on the wax of the honeycomb.

The four families are:

1. *Chilidæ*—five species.
2. *Crambidæ*—about thirty species.
3. *Phycidæ*—over forty species.
4. *Galleridæ*—five species.

Chilo Phragmitellus

This species is one of those moths known as the 'Veneers,' and is popularly termed the Wainscot Veneer. It is one of the largest of the family *Chilidæ*.

Its fore wings are long, narrow, and pointed at the tip. They are of a pale ochreous brown colour, with a row of small black dots along the hind margin.

Its caterpillar is pale grey, with brown stripes; and the head and second segment are yellowish brown. It feeds on the common reed (*Phragmites*) in the autumn, and hybernates till the following spring, when it resumes its feeding.

This insect is rather local, but may be searched for in all marshy places where reeds abound.

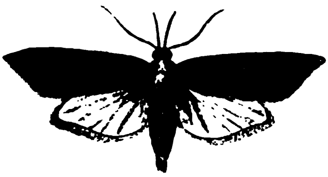


FIG. 219.—PHRAGMITELLUS—ENLARGED ONE-HALF.

Crambus hamellus

The family *Crambidæ* is represented by the above-named species, which has the popular title of Pearl-streak Veneer. It is not a common moth, but is to be obtained in some localities by beating low herbage.

Its fore wings are ochreous and glossy, with a silvery streak from the base, running almost parallel with the costal margin. The hind margin is yellow, bordered inside by a wavy brown line. The hind wings are pale greyish brown with a yellowish margin.

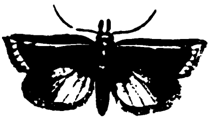


FIG. 220.—HAMELLUS—SLIGHTLY ENLARGED.

Crambus tristellus

The same family contains the species *Tristellus*, which, unlike the preceding insect, is abundant everywhere.

Its fore wings are generally yellowish brown, but exceedingly variable. A pale streak runs from the base to just beyond the middle of the wing, and is then forked. Near the hind margin is a very indistinct brown wavy line. The hind wings are dull smoke colour with a light fringe. As with the other moths of the family, its labial palpi are very long.

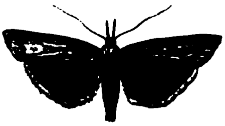


FIG. 221.—TRISTELLUS.

The moth flies from July to September.

Crambus hortuellus

This is also an abundant species, to be met with everywhere during June and July.

Its fore wings are dull ochreous brown. The wing rays are whitish near the inner margin, and a brown line with a silvery edging crosses near the hind margin. The hind wings are dull smoky brown, with a shining surface, and the fringe is light.

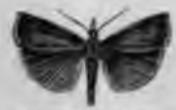


FIG. 222.—HORTULLUS.

The larva is pale grey with dark grey spots, and may be found among moss in April and May.

Galleria mellonella

Our last example of the *Crambi* is a moth that the young entomologist is not likely to meet with unless he happens to be in the neighbourhood of one of its haunts, but its habits are so peculiar that we are tempted to introduce it on that account.

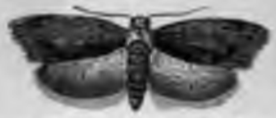


FIG. 223.—MELLONELLA.

It belongs to the family *Galleridæ*, the larvæ of which feed on the wax combs in the hives of bees and in the nests of wild bees. They are protected from the stings of the inmates by silken tubes which they construct, and by the hardened covering of their heads and front segments—the only parts that remain exposed while they are feeding.

The fore wings of the moth are reddish-grey or brownish, sometimes with a greenish tinge, and yellowish along the inner margin. The hind wings are greyish brown.

It flies in July and August, and the caterpillar feeds in May and June.

The Tortrices

This is a large group of moths, deriving their name from the peculiar habit of a number of the larvæ of twisting or rolling up leaves for their protection. This habit, however, is not common to all, for some feed on stems and flowers, and others devour seeds and fruits.

The perfect insects may easily be known by the shape of the wings. The fore pair are gracefully curved on the costal margin in such a way that, when the insect is at rest with its wings closed, its outline [illegible] the shape of a bell.

The [illegible] of the various species of this extensive group [illegible] many of them are so variable in their colouring that [illegible] of the same species are often very different from each other. So puzzling indeed is this tendency to run into varieties that many insects, once considered to belong to separate species, have been reduced to one; and this has been the case in a number of instances.

There are so many of these little moths that we cannot even give a representative of each family, but the following outline will serve to show the extensiveness of the group.

Family 1. *Tortricidæ*, about sixty species.
„ 2. *Penthinidæ*, „ twenty „
„ 3. *Spilonotidæ*, „ twelve „
„ 4. *Sericoridæ*, „ twenty-seven species.
„ 5. *Sciaphilidæ*, „ twenty-four „
„ 6. *Grapholithidæ*, about one hundred and fifty species.
„ 7. *Pyraloididæ*, four species.
„ 8. *Conchylidæ*, about fifty species.
„ 9. *Apheliidæ*, three species.

We shall now briefly examine a few of the commonest insects of the group.

Tortrix xylosteana

This pretty moth is common in most parts, and may often be met with in abundance in wooded localities during July. It belongs to the family *Tortricidæ*.

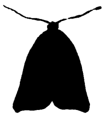


FIG. 224.—XYLOSTEANA WITH WINGS CLOSED.

Its fore wings are ochreous brown. A very dark oblique streak, edged with yellow, runs from the inner margin of the base. A reddish patch in the centre of the wing, also edged with yellow, is narrow on the costa, and expands as it approaches the inner margin. Beyond this are another dark patch on the costa and two reddish-brown blotches on the hind margin.

The larva is greenish brown, marked with white spots which have black centres; and it feeds on oak (*Quercus Robur*), honeysuckle (*Lonicera Periclymenum*), and other plants, in the month of May.

Tortrix viridana

In June and July this pretty but destructive little insect may be seen flying in abundance in almost every oak wood. Its fore wings are one uniform pale green with the exception of a streak of yellow along the costal margin; and, when at rest, scores may exist on a single twig without being seen unless closely examined. The hind wings are of a pale smoky tint, and rather glossy.

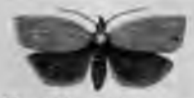


FIG. 225.—VIRIDANA.

The larva is green, with black spots, and feeds in May and June on the oak and other trees, often almost completely devouring the foliage.

Peronea cristana

This moth is not so generally abundant, but is very common in many of the woods of the south. It is remarkable for the large number of varieties that have been observed, many of which have been regarded as distinct species.

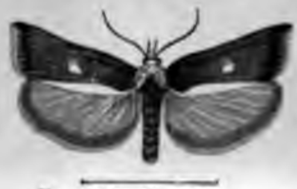


FIG. 226.—CRISTANA—ENLARGED.

Its fore wings are of some shade of brown or grey, with a light streak of variable colour along the inner margin, and a tuft of raised white scales in the middle of the wing.

It flies during August and September.

Ptycholoma lecheana

Our last example of the family *Tortricidæ* is *Lecheana*, a moth that is common in most parts in June and July.

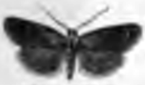


FIG. 227.—LECHEANA.

Its fore wings are brown, lighter towards the base. There are no very distinct markings, but there is generally a darker patch in the middle of the wing, edged with a silvery streak on each side.

The larva feeds on several trees, including oaks and elms, in the month of May.

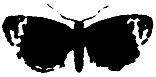


FIG. 228.—PRUNIANA.

Penthina pruniana

The next family *Penthinidæ* contains the common species *Pruniana*, which may be readily known by its boldly marked wings. The basal portion of the fore wings, to the extent of nearly two-thirds of the whole, is very dark brown. The remaining third is almost white, shaded with grey. The hind wings are smoky brown with a paler fringe.

The caterpillar of this species feeds on the blackthorn (*Prunus spinosa*) in May, and the moth flies in June and July.

Antithesia salicella

This moth is not nearly so common as the last species, but is fairly plentiful in some localities in the south of England. It belongs to the same family as *Pruniana*.

The fore wings are whitish at the base and along the inner margin, but the light tint is dotted and clouded with shades of brown. The remainder of the wings is marbled with dark brown of different depths, relieved near the hind margin with a little blue. The hind wings, as is usual with the *Tortrices*, are dull smoky brown.

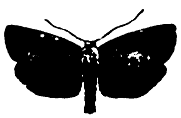


FIG. 229.—SALICELLA.

The caterpillar is reddish brown with black spots, and feeds during May in rolled leaves of willows.

The moth flies in August and September.

Sciaphila octomaculana

Our single example of the family *Sciaphilidæ* is the species *Octomaculana*, which, though not very abundant, is widely distributed, and moderately common in parts.

Its fore wings are white, dusted with grey, and each is marked with four dark grey patches which have given rise to its specific name—a word which signifies 'eight-spotted.' The hind wings are grey.

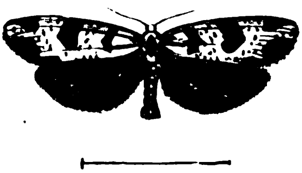


FIG. 230.—OCTOMACULANA—ENLARGED.

The caterpillar feeds on thistles and other plants, and the moth flies from August to October.

Ephippiphora cirsiana

This insect represents the family *Grapholithidæ*. It is a common moth, and is widely distributed.

Its fore wings are greyish brown, with a large white patch on the middle of the inner margin; and beyond this white, in the anal angle, is a pale grey patch containing three or four black dots. The tips of the wings are reddish brown.

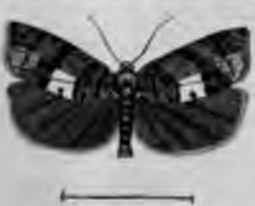


Fig. 231.—Cirsiana—Enlarged.

The moth flies in June and July; and the larva, which feeds on thistles, may be found in the stems from October to the following May.

Carpocapsa pomonella

The same extensive family contains a few moths that are very destructive to our fruits, the larvæ burrowing into and living entirely within their substance. One of these — *Pomonella* — is popularly known as the Codlin, as its larva is so often found in the interior of small apples of the same name.

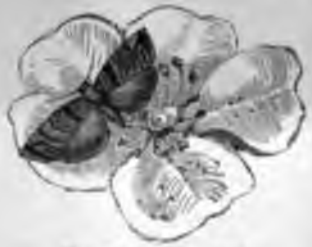


Fig. 232.—Pomonella.

The fore wings of this insect are grey, with a number of dark transverse lines. The spot in the anal angle is edged with a coppery tint, and inclosed by a curved black line.

This moth is common in all parts, flying during June and July; and the larva may be looked for in apples and pears in August and September.

Xanthosetia zoegana

Our last example of the *Tortrices* is *Zoegana*, which belongs to the family *Conchylidæ*. Its fore wings are yellow, with a reddish streak along the costa near the base, and a small reddish spot opposite this near the inner margin. The tip of the wings is dark reddish brown, in the middle of which is a large yellow spot.

Fig. 233.—Zoegana—Enlarged.

This moth is widely distributed, and in some parts common. It flies from May to August, and the larva feeds on the small scabious (*Scabiosa columbaria*).

The Tineæ

We have noticed that the *Tortrices* form a very extensive group of moths, but they are far outnumbered by the *Tineæ*, for of these there are over seven hundred known British species.

Of course, among so many species we are sure to find considerable variety in form and structure; but notwithstanding this, the *Tineæ* form a well-marked division, and the beginner will find but little difficulty in distinguishing between these and the other Micros.

The wings are long and narrow, and are remarkable for the length of the fringe, particularly that of the hind wings. The bodies, too, are long and slender.

The larvæ are exceedingly variable. Some have the usual number of sixteen limbs, and others have as many as eighteen. Again, the larvæ of several genera have only fourteen legs, and some are absolutely legless.

With regard to their food and habits, they are equally variable, for while some feed exposed, others are always protected in rolled leaves. Some construct for themselves portable tubes, so that they always remain under cover, and are at the same time perfectly free to ramble in search for food. Some, also, are leaf miners; and the group includes the so-called 'Clothes Moths,' whose larvæ devour our garments, furs, and the upholstering of our furniture.

We shall now briefly notice a few species, in order that we may become better acquainted with the general characters of the group.

Diurnea fagella

This moth represents the small family *Epigraphiidæ*, containing only six species, all of which appear in the winter or early spring.

The present species is very common in most parts, and may be seen at rest on the barks of trees in March and April.

The fore wings are usually pale grey or yellowish grey, and dotted with brown; but there is a great variety both in the depth of the ground colour and the distinctness of the markings. Our illustration gives the usual appearance of the insect.

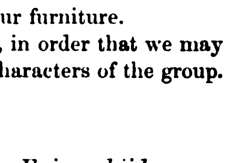


FIG. 234.—FAGELLA.

The caterpillar feeds on various trees in September and October, always protected between leaves that it has spun together.

Adela cuprella

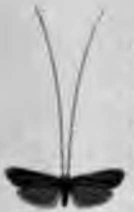


Fig. 235.—Cuprella.

The family *Adelidæ* contains ten species, all remarkable for the great length of their antennæ. The one selected for illustration is a beautiful little moth with bright bronzy green fore wings, tinged with a rich glossy violet. The hind wings are brown with a glossy surface.

This moth does not seem to be widely distributed, but is fairly plentiful where it occurs. Wimbledon Common and Epping Forest are good localities for it. It is on the wing in April and May.

Hyponomeuta Padellus

The family *Hyponomeutidæ* contains about twenty insects, some of which are very common and exceedingly destructive to our trees. In May and June hawthorn and fruit trees may be seen swarming with the gregarious larvæ of some of them, and almost entirely stripped of their leaves.

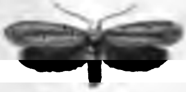


Fig. 236.—Padellus.

The species here figured has grey or white fore wings with three rows of black dots. The hind wings are darker grey without dots. The larva feeds on hawthorn, apple, and other trees. The perfect insect flies in July and August.

Depressaria nervosa

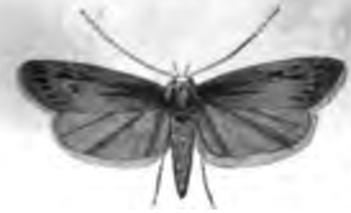


Fig. 237.—Nervosa. Twice Natural Size.

The next family—*Gelechiidæ*—is represented by the species *Nervosa*, which is common in many localities.

Its fore wings are reddish brown, and are marked by a number of short longitudinal streaks of a darker colour. The hind wings are light grey.

The caterpillar is black, marked with black spots in white rings, and having yellow side stripes. It feeds on the flowers of the hemlock water dropwort (*Œnanthe crocata*) during June and July.

The moth flies in August and September.

Harpella Geoffrella

The same extensive family contains the moth Geoffrella, represented in the accompanying cut. This is an exceedingly pretty insect. The basal portion of its fore wings is yellow, with two longitudinal dark streaks, the outer one of which is bent towards the inner margin near the middle of the wing. The remaining portion of the wings is brown, with two yellowish triangular spots, one on the costal and one on the inner margin. On the middle of the costa is a short dark streak.

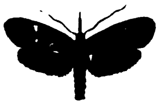


FIG. 238.—GEOFFRELLA.

This moth appears in May and June, and is rather local, but very abundant in some parts.

Coleophora ibipennella

The family *Coleophoridæ* contains about seventy small moths, characterised by their very narrow and pointed wings, with long fringes, and also, generally, by a little tuft of hair on the first joint of the antennæ.

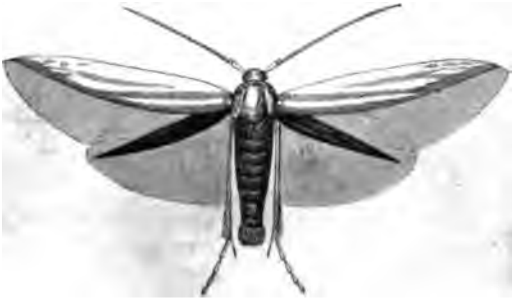


FIG. 239.—IBIPENNELLA—ENLARGED.

The larvæ live in little cases which they construct, and feed on various leaves and seeds. They spend the winter within their cases, and change to the chrysalis state in spring or early summer.

One of these moths—*Ibipennella*—is shown in fig. 239. Its fore wings are white, with a satiny gloss, and brownish towards the tips. The 'nervures' are generally of a yellowish tinge. The hind wings are dark grey.

The larva feeds on the birch (*Betula alba*), and may be seen walking on the surface of the leaves, carrying, or rather dragging after it, the pistol-shaped case in which it lives, nothing protruding save its head and front legs. It is full fed in May, and the moth flies in July.

Tischeria complanella

This species represents the rather extensive family *Elachistidæ*, the members of which have narrow and pointed wings. Many of them are adorned with beautiful metallic tints, but are generally so small that a lens is necessary to show up the splendour of their clothing. Most of the larvæ are leaf miners, and are easily reared. All that is necessary is to pluck a few twigs, the leaves of which, when held up to the light, reveal the tiny larvæ in their burrows, and place them in a vessel of water. They do not feed long, and it is probable that most of the larvæ so treated will be ready to change before the leaves have become dry. The present species has bright yellow fore wings, with pale grey cloudings at the hind margins. It is very abundant in many parts, and flies during the month of June.

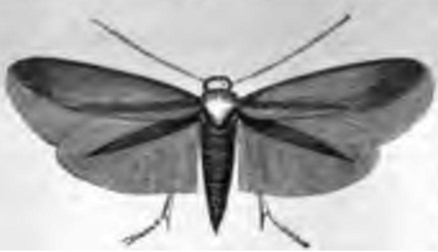


FIG. 240.—COMPLANELLA—ENLARGED.

The larva is one of the numerous leaf miners, and is of a yellowish colour. It feeds in oak leaves during the autumn, and its presence is indicated by light blotches on the foliage.

Nepticula aurella

The family *Nepticulidæ*—the last of the *Tineæ*—contains a number of little moths, including the smallest of the *Lepidoptera*. Many of them are exceedingly beautiful, being decorated with various tints of a splendid metallic lustre, but their beauty is revealed only by the use of a magnifying lens, and they are so small that very great care and patience is required to set them properly.

They may be recognised by their short and thick antennæ, rather large head, broad fore wings, and narrow pointed hind wings.

The larvæ have no true legs, but have nine pairs of very imperfectly developed claspers. They are leaf miners, and are sometimes so abundant that several may be found in a single leaf.

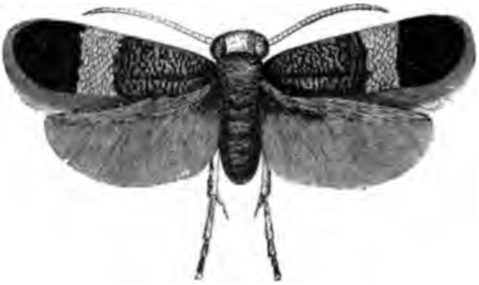


FIG. 241.—AURELLA—ENLARGED.

The species we have selected has fore wings of a rich golden brown, with deep violet tips, and a broad bar of pale golden yellow beyond the middle. It may be found throughout the spring and summer. The larva excavates long irregular burrows in the leaves of the bramble.

APPENDICES

APPENDIX I

I HAVE previously called the reader's attention to our classified list of butterflies and moths, and have hinted at one or two of the objects for which it is inserted. It contains the scientific and popular names of all the British Butterflies, *Sphinges*, *Bombyces*, *Noctuæ*, and *Geometræ*, arranged in their various families and genera; and in cases where two specific names are commonly applied to the same insect, both are given.

Its chief uses to the young entomologist are to show the relation which the insects bear one to another, and to supply a guide for the proper arrangement of the specimens in his cabinet.

The order adopted is that of South's 'Synonymic List of British Lepidoptera,' and it has already been mentioned that similar lists, printed on one side of the paper only, may be obtained from dealers in naturalists' appliances. These, cut up as required, supply very neat labels for cabinets or store boxes.

COMPLETE CLASSIFIED LIST OF BRITISH MACRO-LEPIDOPTERA

RHOPALOCERA (BUTTERFLIES).

PAPILIONIDÆ.
Papilio.
Machaon—Swallow Tail
PIERIDÆ.
Aporia.
Cratægi—Black-veined White
Pieris.
Brassicæ—Large White
Rapæ—Small White
Napi—Green-veined White
Daplidice—Bath White
Euchloë.
Cardamines—Orange Tip
Leucophasia.
Sinapis—Wood White
Colias.
Hyale—Pale Clouded Yellow
Edusa—Clouded Yellow
Gonopteryx.
Rhamni—Brimstone
NYMPHALIDÆ
Argynnis.
Selene—Small Pearl-bordered Fritillary
Euphrosyne—Pearl-bordered Fritillary

NYMPHALIDÆ—*cont.*
Argynnis—*cont.*
Latona—Queen of Spain
Aglaia—Dark Green Fritillary
Adippe—High Brown Fritillary
Paphia—Silver-washed Fritillary
Melitæa.
Aurinia (*Artemis*)—Greasy Fritillary
Cinxia—Glanville Fritillary
Athalia—Heath Fritillary
Vanessa.
C-Album—Comma
Polychloros—Large Tortoiseshell
Urticæ—Small Tortoiseshell
Io—Peacock
Antiopa—Camberwell Beauty
Atalanta—Red Admiral
Cardui—Painted Lady
Limenitis.
Sibylla—White Admiral
APATURIDÆ.
Apatura.
Iris—Purple Emperor
SATYRIDÆ.
Melanargia.
Galatea—Marbled White
Erebia.
Epiphron (*Cassiope*)—Small Ringlet
Æthiops (*Blandina*)—Northern Brown (Scotch Argus)
Pararge.
Egeria—Speckled Wood
Megæra—Wall
Satyrus.
Semele—Grayling
Epinephele.
Janira—Meadow Brown
Tithonus—Large Heath (Small Meadow Brown)

Epinephele—*cont.*
Hyperanthes—Ringlet
Cœnonympha.
Typhon (*Davus*)—Marsh Ringlet
Pamphilus—Small Heath
LYCÆNIDÆ.
Thecla.
Betulæ—Brown Hairstreak
W-Album—White-letter Hairstreak
Pruni—Dark Hairstreak
Quercus—Purple Hairstreak
Rubi—Green Hairstreak
Polyommatus.
Dispar—Large Copper
Phlœas—Small Copper
Lycæna.
Bœtica—Tailed Blue
Ægon—Silver-studded Blue
Astrarche (*Agestis*)—Brown Argus
Icarus (*Alexis*)—Common Blue
Bellargus (*Adonis*)—Clifden Blue
Corydon—Chalk-hill Blue
Argiolus—Azure or Holly Blue
Semiargus (*Acis*)—Mazarine Blue
Minima (*Alsus*)—Small Blue
Arion—Large Blue
ERYCINIDÆ.
Nemeobius.
Lucina—Duke of Burgundy
HESPERIIDÆ.
Syrichthus.
Malvæ (*Alveolus*)—Grizzled Skipper
Nisoniades.
Tages—Dingy Skipper
Hesperia.
Thaumas (*Linea*)—Small Skipper
Lineola—New Small Skipper
Actæon—Lulworth Skipper
Sylvanus—Large Skipper

HESPERIIDÆ—*cont.*

Hesperia—*cont.*

Comma—Silver-spotted Skipper

Carterocephalus.

Palæmon (*Paniscus*) — Chequered Skipper

HETEROCERA (MOTHS).

SPHINGES.

SPHINGIDÆ.

Acherontia.

Atropos—Death's Head Hawk Moth

Sphinx.

Convolvuli—Convolvulus Hawk

Ligustri—Privet Hawk

Pinastri—Pine Hawk

Deilephila.

Euphorbiæ—Spurge Hawk

Galii—Bedstraw Hawk

Livornica—Striped Hawk

Chærocampa.

Celerio—Silver-striped Hawk

Porcellus—Small Elephant

Elpenor—Large Elephant

Smerinthus.

Ocellatus—Eyed Hawk

Populi—Poplar Hawk

Tiliæ—Lime Hawk

Macroglossa.

Stellatarum—Humming-bird Hawk

Fuciformis—Broad-bordered Bee Hawk

Bombyliformis—Narrow-bordered Bee Hawk

SESIIDÆ.

Trochilium.

Apiformis—Hornet Clearwing of the Poplar

Crabroniformis (*Bembeciformis*)—Hornet Clearwing of Osier

Sciopteron.

Tabaniformis (*Vespiforme*) Dusky Clearwing

Sesia.

Scoliiformis—Welsh Clearwing

Sphegiformis—White-barred Clearwing

Andreniformis—Orange-tailed Clearwing

Tipuliformis—Currant Clearwing

Asiliformis (*Cynipiformis*)—Yellow-legged Clearwing

Myopiformis—Red-belted Clearwing

Culiciformis—Large Red-belted Clearwing

Formiciformis—Red-tipped Clearwing

Ichneumoniformis—Six-belted Clearwing

Musciformis (*Philanthiformis*)—Thrift Clearwing

Chrysidiformis—Fiery Clearwing

ZYGÆNIDÆ.

Ino.

Globulariæ—Scarce Forester

Statices—Forester

Geryon—Cistus Forester

Zygæna.

Pilosellæ (*Minos*)—Transparent Burnet

Exulans—Scotch Burnet

Meliloti—New Forest Burnet

Trifolii—Broad-bordered Five-spotted Burnet

Loniceræ—Narrow-bordered Five-spotted Burnet

Filipendulæ—Six-spotted Burnet

BOMBYCES.

NYCTEOLIDÆ
Sarothripus.
Undulanus—Tortrix Moth
Earias.
Chlorana—Cream-bordered Green
Hylophila.
Prasinana—Green Silver-lined
Bicolorana (*Quercana*)—Large Green Silver-lined
NOLIDÆ.
Nola.
Cucullatella—Short-cloaked
Strigula—Small Black Arches
Confusalis (*Cristulalis*)—Least Black Arches
Albulalis—Kent Arches
Centonalis—Scarce Black Arches
LITHOSIIDÆ.
Nudaria.
Senex—Round-winged Muslin
Mundana—Muslin Moth
Setina.
Irrorella—Dew Moth
Calligenia.
Miniata—Rosy Footman (Red Arches)
Lithosia.
Mesomella—Four-dotted Footman
Muscerda—Dotted Footman
Sororcula (*Aureola*)—Orange Footman
Lutarella (*Pygmæola*)—Pigmy Footman
Griseola (*Stramineola*) Pale Footman
Deplana (*Helveola*)—Buff Footman
Lurideola (*Complanula*)—Common Footman
Complana—Scarce Footman
Sericea (*Molybdeola*)—Northern Footman
Lithosia—*cont.*
Caniola—Hoary Footman
Gnophria.
Quadra—Four-spotted Footman
Rubricollis—Red-necked Footman
Emydia.
Cribrum—Speckled Footman
EUCHELIIDÆ
Deiopeia.
Pulchella—Crimson Speckled
Euchelia.
Jacobææ—Cinnabar
Callimorpha.
Dominula—Scarlet Tiger
Hera—Jersey Tiger
CHELONIIDÆ.
Nemeophila.
Russula—Clouded Buff
Plantaginis—Wood Tiger
Arctia.
Caia—Tiger
Villica—Cream-spot Tiger
Spilosoma.
Fuliginosa—Ruby Tiger
Mendica—Muslin
Lubricipeda—Buff Ermine
Menthastri—White Ermine
Urticæ—Water Ermine
HEPIALIDÆ.
Hepialus.
Humuli—Ghost Swift
Sylvanus—Wood Swift
Velleda—Northern Swift
Lupulinus—Common Swift
Hectus—Gold Swift
COSSIDÆ.
Cossus
Ligniperda—Goat
Zeuzera
Æsculi—Wood Leopard
Macrogaster
Castaneæ (*Arundinis*)—Reed Moth

COCHLIOPODIDÆ.

Heterogenea.
Limacodes (*Testudo*)—Festoon Moth
Asella (*Asellus*)—Triangle Moth

LIPARIDÆ.

Porthesia (Liparis).
Chrysorrhœa—Brown Tail
Similis (*Auriflua*)—Yellow Tail (Gold Tail)
Leucoma.
Salicis—Satin Moth
Læelia.
Cœnosa—Reed Tussock
Ocneria.
Dispar—Gipsy
Psilura.
Monacha—Black Arches
Dasychira.
Fascelina—Dark Tussock
Pudibunda—Pale Tussock
Orgyia.
Gonostigma—Scarce Vapourer
Antiqua—Vapourer

BOMBYCIDÆ.

Trichiura.
Cratægi—Pale Oak Eggar
Pœcilocampa.
Populi—December Moth
Eriogaster.
Lanestris—Small Eggar
Bombyx.
Neustria—Lackey
Castrensis—Ground Lackey
Rubi—Fox
Quercus—Oak Eggar
Trifolii—Grass Eggar
Odonestis.
Potatoria—Drinker
Lasiocampa.
Quercifolia—Lappet
Ilicifolia—Small Lappet

ENDROMIDÆ

Endromis.
Versicolor—Kentish Glory

SATURNIIDÆ.

Saturnia.
Pavonia (*Carpini*)—Emperor

DREPANULIDÆ.

Drepana.
Lacertinaria (*Lacertula*)—Scalloped Hook Tip
Harpagula (*Sicula*)—Scarce Hook Tip
Falcataria (*Falcula*)—Pebble Hook Tip
Binaria (*Hamula*)—Oak Hook Tip
Cultraria (*Unguicula*)—Barred Hook Tip
Cilix.
Glaucata (*Spinula*)—Chinese Character

DICRANURIDÆ.

Dicranura.
Bicuspis—Alder Kitten
Furcula—Sallow Kitten
Bifida—Poplar Kitten
Vinula—Puss
Stauropus.
Fagi—Lobster

NOTODONTIDÆ.

Glyphisia
Crenata—Dusky Marbled Brown
Ptilophora.
Plumigera—Plumed Prominent
Pterostoma.
Palpina—Pale Prominent
Lophopteryx.
Camelina—Coxcomb Prominent
Cuculla (*Cucullina*)—Maple Prominent
Carmelita—Scarce Prominent
Notodonta.
Bicolor—White Prominent
Dictæa—Swallow Prominent
Dictæoides—Lesser Swallow Prominent

NOTODONTIDÆ—*cont.*

Notodonta—*cont.*

Dromedarius—Iron Prominent
Trilophus—Three-humped Prominent
Ziczac—Pebble Prominent
Trepida—Great Prominent
Trimacula (*Dodonea*)—Marbled Brown
Chaonia—Lunar Marbled Brown

PYGÆRIDÆ.

Phalera.

Bucephala—Buff Tip

Pygæra (Clostera).

Curtula—Chocolate Tip

Pygæra—*cont.*

Anachoreta—Scarce Chocolate Tip
Pigra (*Reclusa*)—Small Chocolate Tip

CYMATOPHORIDÆ.

Thyatira

Derasa—Buff Arches
Batis—Peach Blossom

Cymatophora.

Octogesima (*Ocularis*)—Figure of Eighty
Or—Poplar Lutestring
Duplaris—Lesser Satin
Fluctuosa—Satin Carpet

Asphalia.

Diluta—Lesser Lutestring
Flavicornis—Yellow-horned
Ridens—Frosted Green

NOCTUÆ.

BRYOPHILIDÆ.

Bryophila.

Algæ—Tree Lichen Beauty
Muralis (*Glandifera*)—Marbled (Mottled) Green
Par—Scarce Marbled Green
Perla—Marbled Beauty

BOMBYCOIDÆ.

Moma (Diphthera).

Orion—Scarce Marvel-du-jour

Demas.

Coryli—Nut-tree Tussock

Acronycta.

Tridens—Dark Dagger
Psi—Grey Dagger
Leporina—Miller
Aceris—Sycamore
Megacephala—Poplar Grey
Strigosa—Grisette
Alni—Alder
Ligustri—Coronet
[illegible]—Knot-grass
Auricoma—Scarce Dagger
Menyanthidis—Light Knot-[illegible]

Acronycta—*cont.*

Euphorbiæ (*Myricæ*)—Sweet Gale

Diloba.

Cæruleocephala—Figure of Eight

Arsilonche.

Albovenosa (*Venosa*)—Powdered Wainscot

LEUCANIIDÆ.

Synia.

Musculosa—Brighton Wainscot

Leucania.

Conigera—Brown-line Bright-eye
Vitellina—Delicate
Turca—Double Line
Lithargyria—Clay
Albipuncta—White-point
Extranea—American Wainscot
Obsoleta—Obscure Wainscot
[illegible]—Devonshire Wainscot
Littoralis—Shore Wainscot

LEUCANIIDÆ—*cont.*

Leucania—*cont.*

Impudens (*Pudorina*)—Striped Wainscot
Comma—Shoulder-striped Wainscot
Straminea—Southern Wainscot
Impura—Smoky Wainscot
Pallens—Common Wainscot

Calamia.

Phragmitidis—Fen Wainscot

Meliana.

Flammea - Flame Wainscot

Senta.

Maritima—Silky Wainscot

Cœnobia.

Rufa—Small Rufous

Tapinostola.

Fulva—Small Wainscot
Hellmanni—Mere Wainscot
Extrema (*Concolor*)—Concolorous Wainscot
Bondii—Bond's Wainscot
Elymi—Lyme Wainscot

Nonagria.

Cannæ—Reed Wainscot
Sparganii—Iris Wainscot
Arundinis (*Typhæ*)—Bull-rush
Geminipuncta—Twin-spotted Wainscot
Neurica—Nerved Wainscot
Brevilinea—Fenn's Nonagria
Lutosa—Large Wainscot

APAMEIDÆ.

Gortyna.

Ochracea (*Flavago*)—Frosted Orange

Hydrœcia.

Nictitans—Golden Ear
Petasitis—Butter-bur
Micacea—Rosy Rustic

Axylia.

Putris—Flame

Xylophasia.

Rurea—Clouded-border Brindle

Xylophasia—*cont.*

Lithoxylea—Light Arches
Sublustris—Reddish Light Arches
Monoglypha (*Polyodon*)—Dark Arches
Hepatica—Clouded Brindle
Scolopacina—Slender Clouded Brindle

Dipterygia.

Scabriuscula (*Pinastri*)—Bird's Wing

Cloantha.

Polyodon (*Perspicillaris*)—Purple Cloud

Aporophyla.

Australis—Feathered Brindle

Laphygma.

Exigua—Small Mottled Willow

Neuria.

Reticulata (*Saponariæ*)—Bordered Gothic

Neuronia.

Popularis—Feathered Gothic

Heliophobus.

Hispidus—Beautiful Gothic

Charæas.

Graminis—Antler

Pachetra.

Leucophæa—Feathered Ear

Cerigo.

Matura (*Cytherea*)—Straw Underwing

Luperina.

Testacea—Flounced Rustic
Dumerili—Dumeril's Luperina
Cespitis—Hedge Rustic

Mamestra.

Abjecta—Crescent Striped
Sordida (*Anceps*)—Large Nutmeg
Albicolon—White Colon
Furva—Confused
Brassicæ—Cabbage
Persicariæ—Dot

APAMEIDÆ—*cont.*

Apamea.

Basilinea—Rustic Shoulder Knot

Connexa—Union Rustic

Gemina—Dusky Brocade

Unanimis—Small Clouded Brindle

Ophiogramma—Double Lobed

Leucostigma (*Fibrosa*)—Crescent

Didyma (*Oculea*)—Common Rustic

Miana.

Strigilis—Marbled Minor

Fasciuncula—Middle-barred Minor

Literosa—Rosy Minor

Bicoloria (*Furuncula*)—Cloaked Minor

Arcuosa—Dotted Buff

Phothedes.

Captiuncula—Least Minor

Celæna.

Haworthii—Haworth's Minor

CARADRINIDÆ

Grammesia.

Trigrammica (*Trilinea*)—Treble Lines

Stilbia.

Anomala—Anomalous

Caradrina.

Morpheus—Mottled Rustic

Alsines—Uncertain

Taraxaci (*Blanda*)—Rustic

Ambigua—Ambiguous

Quadripunctata (*Cubicularis*)—Pale Mottled Willow

Acosmetia.

Caliginosa—Reddish Buff

Hydrilla.

Palustris—Marsh Moth

Rusina.

Tenebrosa—Brown Rustic

NOCTUIDÆ.

Agrotis.

Vestigialis (*Valligera*)—Archer's Dart

Puta—Shuttle-shaped Dart

Suffusa—Dark Sword Grass

Saucia—Pearly Underwing

Segetum—Common Dart (Turnip Moth)

Lunigera—Crescent Dart

Exclamationis—Heart and Dart

Corticea—Heart and Club

Cinerea—Light Feathered Rustic

Ripæ—Sand Dart

Cursoria—Coast Dart

Nigricans—Garden Dart

Tritici—White-line Dart

Aquilina—Streaked Dart

Obelisca—Square-spot Dart

Agathina—Heath Rustic

Strigula (*Porphyrea*)—True Lover's Knot

Præcox—Portland

Obscura (*Ravida*)—Stout Dart

Simulans (*Pyrophila*)—Dotted Rustic

Lucernea—Northern Rustic

Ashworthii—Ashworth's Rustic

Noctua.

Glareosa—Autumn Rustic

Depuncta—Plain Clay

Augur—Double Dot

Plecta—Flame Shoulder

Flammatra—Black Collar

C-Nigrum—Setaceous Hebrew Character

Ditrapezium—Triple-spotted Clay

Triangulum—Double Square-spot

Stigmatica (*Rhomboidea*)—Square-spotted Clay

Brunnea—Purple Clay

NOCTUIDÆ—*cont.*

Noctua—*cont.*
Festiva (*Conflua*)—Ingrailed Clay
Dahlii—Barred Chestnut
Subrosea—Rosy Marsh
Rubi—Small Square-spot
Umbrosa—Six-striped Rustic
Baia—Dotted Clay
Sobrina—Cousin German
Castanea (*Neglecta*)—Grey Rustic
Xanthographa—Square-spot Rustic

Triphæna.
Ianthina—Lesser Broad Border
Fimbria—Broad-bordered Yellow Underwing
Interjecta—Least Yellow Underwing
Orbona (*Subsequa*)—Lunar Yellow Underwing
Comes (*Orbona*)—Lesser Yellow Underwing
Pronuba—Large Yellow Underwing

AMPHIPYRIDÆ.

Amphipyra.
Pyramidea—Copper Underwing
Tragopogonis—Mouse

Mania.
Typica—Gothic
Maura—Old Lady

ORTHOSIIDÆ.

Panolis.
Piniperda—Pine Beauty

Pachnobia.
Leucographa—White-marked
Rubricosa—Red Chestnut
Hyperborea (*Carnica*)—Mountain Rustic

Tæniocampa.
Gothica—Hebrew Character
Incerta (*Instabilis*)—Clouded Drab

Tæniocampa—*cont.*
Opima—Northern Drab
Populeti—Lead-coloured Drab
Stabilis—Common Quaker
Gracilis—Powdered Quaker
Miniosa—Blossom Underwing
Munda—Twin-spotted Quaker
Pulverulenta (*Cruda*)—Small Quaker

Orthosia.
Suspecta—Suspected
Upsilon—Dismal
Lota—Red-lined Quaker
Macilenta—Yellow-lined Quaker

Anchocelis.
Rufina—Flounced Chestnut
Pistacina—Beaded Chestnut
Lunosa—Lunar Underwing
Litura—Brown-spot Pinion

Cerastis (Glæa).
Vaccinii—Chestnut
Spadicea—Dark Chestnut
Erythrocephala—Red-headed

Scopelosoma.
Satellitia—Satellite

Dasycampa.
Rubiginea—Dotted Chestnut

Oporina.
Croceago—Orange Upperwing

Xanthia.
Citrago—Orange Sallow
Fulvago (*Cerago*)—Sallow
Flavago (*Silago*)—Pink-barred Sallow
Aurago—Barred Sallow
Gilvago—Dusky Lemon Sallow
Circellaris (*Ferruginea*)—Brick

Cirrhœdia.
Xerampelina—Centre-barred Sallow

COSMIIDÆ.

Tethea.

Subtusa—Olive

Retusa—Double Kidney

Cosmia (Euperia).

Paleacea (*Fulvago*)—Angle-striped Sallow

Dicycla.

Oo—Heart Moth

Calymnia.

Trapezina—Dun-bar

Pyralina—Lunar-spotted Pinion

Diffinis—White-spotted Pinion

Affinis—Lesser-spotted Pinion

HADENIDÆ.

Eremobia.

Ochroleuca—Dusky Sallow

Dianthœcia.

Luteago (*Barrettii*)—Barrett's Marbled Coronet

Cæsia—Grey Marbled Coronet

Nana (*Conspersa*)—Marbled Coronet

Albimacula—White Spot

Compta—The Shears

Capsincola—Lychnis

Cucubali—Campion

Carpophaga—Tawny Shears

Capsophila—Pod-lover

Irregularis (*Echii*)—Viper's Bugloss

Hecatera

Chrysozona (*Dysodea*)—Small Ranunculus

Serena—Broad-barred White

Polia.

Chi—Grey Chi

Flavicincta—Large Ranunculus

Xanthomista (*Nigrocincta*)—Black-banded

Dasypolia.

Templi—Brindled Ochre

Epunda.

Lichenea—Feathered Ranunculus

Epunda—*cont.*

Lutulenta—Deep-brown Dart

Nigra—Black Rustic

Cleoceris.

Viminalis—Minor Shoulder-knot

Valeria.

Oleagina—Green-brindled Dot

Miselia.

Oxyacanthæ—Green-brindled Crescent

Bimaculosa—Crescent

Agriopis.

Aprilina—Marvel-du-jour

Euplexia.

Lucipara—Small Angle-shades

Phlogophora.

Meticulosa—Angle-shades

Trigonophora.

Flammea (*Empyrea*)—Flame Brocade

Aplecta.

Prasina (*Herbida*)—Green Arches

Occulta—Great Brocade

Nebulosa—Grey Arches

Tincta—Silvery Arches

Advena—Pale Shining Brown

Crymodes.

Exulis (*Assimilis*)—Northern Arches

Hadena.

Porphyrea (*Satura*)—Beautiful Brocade

Adusta—Dark Brocade

Protea—Brindled Green

Glauca—Glaucous Shears

Dentina—Grey Shears

Trifolii (*Chenopodii*)—Nutmeg

Atriplicis—Orache

Dissimilis (*Suasa*)—Dog's Tooth

Oleracea—Bright-line Brown-eye

Pisi—Broom

HADENIDÆ—*cont.*
Hadena—*cont.*
Thalassina—Pale-shouldered Brocade
Contigua—Beautiful Brocade
Genistæ—Light Brocade
Rectilinea—Saxon
XYLINIDÆ.
Xylocampa.
Areola (*Lithoriza*)—Early Grey
Xylomiges.
Conspicillaris—Silver Cloud
Calocampa.
Vetusta—Red Sword Grass
Exoleta—Sword Grass
Solidaginis—Golden-rod Brindled
Xylina.
Ornithopus (*Rhizolitha*)—Grey Shoulder Knot
Semibrunnea—Tawny Pinion
Socia (*Petrificata*)—Pale Pinion
Furcifera (*Conformis*)—Conformist
Lambda—Nonconformist
Asteroscopus.
Nubeculosa—Rannoch Sprawler
Sphinx (*Cassinea*)—Sprawler
Cucullia.
Verbasci—Mullein Shark
Scrophulariæ—Betony Shark
Lychnitis—Lychnis Shark
Asteris—Starwort Shark
Gnaphalii—Cudweed Shark
Absinthii—Wormwood Shark
Chamomillæ—Chamomile Shark
Umbratica—Shark
GONOPTERIDÆ.
Gonoptera.
Libatrix—Herald
PLUSIIDÆ.
Habrostola.
Tripartita (*Urticæ*)—Light Spectacle
Habrostola—*cont.*
Triplasia—Dark Spectacle
Plusia.
Chryson (*Orichalcea*)—Scarce Burnished Brass
Chrysitis—Burnished Brass
Bractea—Gold Spangled
Festucæ—Gold Spot
Iota—Plain Golden Y
Pulchrina—Beautiful Golden Y
Gamma—Silver Y
Interrogationis—Scarce Silver Y
HELIOTHIDÆ.
Anarta.
Melanopa—Broad-bordered White Underwing
Cordigera—Small Dark Yellow Underwing
Myrtilli—Beautiful Yellow Underwing
Heliaca (Heliodes).
Tenebrata (*Arbuti*)—Small Yellow Underwing
Heliothis.
Dipsacea—Marbled Clover
Scutosa—Rare Marbled Clover
Peltigera—Bordered Straw
Armigera—Scarce Bordered Straw
Chariclea.
Umbra (*Marginata*)—Bordered Sallow
ACONTIIDÆ.
Agrophila.
Trabealis (*Sulphuralis*)—Spotted Sulphur
Acontia.
Luctuosa—Four-spotted
ERASTRIIDÆ.
Erastria.
Fasciana (*Fuscula*)—Marbled White Spot
Venustula—Rosy Marbled
Bankia.
Argentula—Silver-barred

ERASTRIIDÆ—*cont.*
Hydrelia.
Uncula (*Unca*)—Silver Hook
ANTHOPHILIDÆ.
Thalpochares (Micra).
Ostrina—Purple Marbled
Parva—Small Marbled
Paula—Scarce Marbled
POAPHILIDÆ.
Phytometra.
Viridaria (*Ænea*)—Small Purple-barred
EUCLIDIIDÆ.
Euclidia.
Mi—Mother Shipton
Glyphica—Burnet Noctua
OPHIUSIDÆ.
Ophiodes.
Lunaris—Lunar Double Stripe
CATEPHIIDÆ.
Catephia.
Alchymista—Alchymist
CATOCALIDÆ.
Catocala.
Fraxini—Clifden Nonpareil
Nupta—Red Underwing
Promissa—Light Crimson Underwing
Sponsa—Dark Crimson Underwing
AVENTIIDÆ.
Aventia.
Flexula—Scallop Barred
TOXOCAMPIDÆ.
Toxocampa.
Pastinum—Black Neck
Craccæ—New Black Neck

BOLETOBIIDÆ.
Boletobia.
Fuliginaria—Waved Black
HERMINIIDÆ.
Rivula.
Sericealis—Straw Dot
Zanclognatha.
Grisealis—Lesser Fan-foot
Tarsipennalis—Fan-foot
Emortualis—Olive Crescent
Herminia.
Cribralis—Dotted Fan-foot
Derivalis—Clay Fan-foot
Pechypogon.
Barbalis—Common Fan-foot
HYPENIDÆ.
Madopa.
Salicalis—Lesser Belle
Bomolocha.
Fontis (*Crassalis*)—Beautiful Snout
Hypena.
Rostralis—Lesser Snout
Proboscidalis—Snout
Hypenodes.
Albistrigalis—White-streak
Costæstrigalis—Ribbed-streak
Tholomiges (Schrankia).
Turfosalis—Tiny Snout
BREPHIDES.
Brephos.
Parthenias—Orange Underwing
Notha—Light Orange Underwing

GEOMETRÆ.

UROPTERYGIDÆ.
Uropteryx.
Sambucaria (*Sambucata*)—Swallow Tail
ENNOMIDÆ.
Epione.
Parallelaria (*Vespertaria*)—Dark-bordered Beauty

Epione—*cont.*
Apiciaria—Bordered Beauty
Advenaria—Little Thorn
Rumia.
Luteolata (*Cratægata*)—Brimstone
Venilia.
Maculata—Speckled Yellow

ENNOMIDÆ—*cont.*
Angerona.
Prunaria—Orange Moth
Metrocampa.
Margaritaria—Light Emerald
Ellopia.
Prosapiaria (*Fasciaria*) — Barred Red
Eurymene.
Dolobraria—Scorched Wing
Pericallia.
Syringaria—Lilac Beauty
Selenia.
Bilunaria (*Illunaria*)—Early Thorn
Lunaria—Lunar Thorn
Tetralunaria (*Illustraria*)—Purple Thorn
Odontopera.
Bidentata—Scalloped Hazel
Crocallis.
Elinguaria —Scalloped Oak
Eugonia.
Autumnaria (*Alniaria*) — Large Thorn
Alniaria (*Tiliaria*)—Canary-shouldered Thorn
Fuscantaria—Dusky Thorn
Erosaria—September Thorn
Quercinaria (*Angularia*)—August Thorn
Himera.
Pennaria—Feathered Thorn
AMPHIDASYDÆ.
Phigalia.
Pedaria (*Pilosaria*) — Pale Brindled Beauty
Nyssia.
Zonaria —Belted Beauty
Hispidaria—Small Brindled Beauty
Lapponaria —Rare Brindled Beauty
Biston.
Hirtaria—Brindled Beauty
Amphidasys.
Strataria (*Prodromaria*)—Oak Beauty
Betularia—Peppered Moth
BOARMIIDÆ.
Hemerophila.
Abruptaria—Waved Umber
Cleora.
Angularia (*Viduaria*)—Speckled Beauty
Glabraria—Dotted Carpet
Lichenaria—Brussels Lace
Boarmia.
Repandata—Mottled Beauty
Gemmaria (*Rhomboidaria*)—Willow Beauty
Abietaria— Satin Carpet
Cinctaria— Ringed Carpet
Roboraria—Great Oak Beauty
Consortaria- Pale Oak Beauty
Tephrosia.
Consonaria—Square Spot
Crepuscularia—Small Engrailed
Biundularia—Engrailed
Luridata (*Extersaria*)—Brindled White-spot
Punctularia- Grey Birch
Gnophos.
Obscuraria—Annulet
Dasydia.
Obfuscaria—Scotch Annulet
Psodos.
Coracina (*Trepidaria*) - Black Mountain Moth
GEOMETRIDÆ.
Pseudoterpna.
Pruinata (*Cytisaria*)—Grass Emerald
Geometra.
Papilionaria—Large Emerald
Vernaria—Small Emerald
Phorodesma.
Pustulata (*Bajularia*)—Blotched Emerald

GEOMETRIDÆ—*cont.*

- **Phorodesma**—*cont.*
  - *Smaragdaria*—Essex Emerald
- **Nemoria.**
  - *Viridata*—Small Grass Emerald
- **Iodis.**
  - *Lactearia*—Little Emerald
- **Hemithea.**
  - *Strigata (Thymiaria)*—Common Emerald

EPHYRIDÆ.

- **Zonosoma.**
  - *Porata*—False Mocha
  - *Punctaria*—Maiden's Blush
  - *Linearia (Trilinearia)*—Clay Triple-lines
  - *Annulata (Omicronaria)*—Mocha
  - *Orbicularia*—Dingy Mocha
  - *Pendularia*—Birch Mocha

ACIDALIIDÆ.

- **Hyria.**
  - *Muricata (Auroraria)*—Golden-bordered Purple
- **Asthena.**
  - *Luteata*—Small Yellow Wave
  - *Candidata*—Small White Wave
  - *Sylvata*—Waved Carpet
  - *Blomeri (Pulchraria)*—Blomer's Rivulet
- **Eupisteria.**
  - *Obliterata (Heparata)*—Dingy Shell
- **Venusia.**
  - *Cambrica (Cambricaria)*—Welsh Wave
- **Acidalia.**
  - *Perochraria*—Ochraceous Wave
  - *Ochrata*—Bright Wave
  - *Rubiginata (Rubricata)*—Tawny Wave
  - *Dimidiata (Scutulata)*—Single-dotted Wave
- **Acidalia**—*cont.*
  - *Bisetata*—Small Fan-footed Wave
  - *Trigeminata*—Treble Brown-spot
  - *Contiguaria*—Greening's Wave
  - *Rusticata*—Least Carpet
  - *Holosericata*—Silky Wave
  - *Dilutaria (Interjectaria)*—Dark Cream Wave
  - *Virgularia (Incanaria)*—Small Dusty Wave
  - *Circellata*—Circellate
  - *Ornata*—Lace Border
  - *Marginepunctata (Promutata)*—Mullein Wave
  - *Straminata*—Dotted-bordered Cream Wave
  - *Subsericeata*—Satin Wave
  - *Immutata*—Lesser Cream Wave
  - *Strigaria*—Streaked Wave
  - *Remutaria*—Cream Wave
  - *Fumata*—Smoky Wave
  - *Strigilaria (Prataria)*—Sub-angled Wave
  - *Imitaria*—Small Blood-vein
  - *Emutaria*—Rosy Wave
  - *Aversata*—Riband Wave
  - *Inornata*—Plain Wave
  - *Degeneraria*—Portland Riband Wave
  - *Emarginata*—Small Scallop
- **Timandra.**
  - *Amataria*—Blood-vein

CABERIDÆ.

- **Cabera.**
  - *Pusaria*—Common White Wave
  - *Rotundaria*—Round-winged Wave
  - *Exanthemata*—Common Wave
- **Bapta.**
  - *Temerata*—Clouded Silver
  - *Bimaculata (Taminata)*—White-pinion Spotted

CABERIDÆ—*cont.*

Aleucis.
Pictaria—Sloe Carpet

MACARIIDÆ.

Macaria.
Alternata—Sharp-angled Peacock
Notata—Peacock
Liturata—Tawny-barred Angle

Halia.
Vauaria (*Wavaria*)—V Moth
Brunneata (*Pinetaria*)—Rannoch Geometer

FIDONIIDÆ.

Strenia.
Clathrata—Latticed Heath

Panagra.
Petraria—Brown Silver-line

Numeria.
Pulveraria—Barred Umber

Scodiona.
Belgiaria—Grey Scalloped Bar

Selidosema.
Ericetaria (*Plumaria*)—Bordered Grey

Fidonia.
Carbonaria—Netted Mountain
Limbaria (*Conspicuata*)—Frosted Yellow

Ematurga.
Atomaria—Common Heath

Bupalus.
Piniaria—Bordered White

Minoa.
Murinata (***Euphorbiata***)—Drab Geometer

Scoria.
Lineata (*Dealbata*)—Black-veined

Aplasta.
Ononaria—Rest-harrow

Sterrha.
Sacraria—Vestal

Lythria.
Purpuraria—Purple-barred Yellow

Aspilates.
Strigillaria—Grass Wave
Ochrearia (*Citraria*)—Yellow Belle
Gilvaria—Straw Belle

ZERENIDÆ.

Abraxas.
Grossulariata—Currant Moth (Magpie)
Sylvata (*Ulmata*)—Clouded Magpie

Ligdia.
Adustata—Scorched Carpet

Lomaspilis.
Marginata—Clouded Border

LIGIIDÆ.

Pachycnemia.
Hippocastanaria—Horse Chestnut

HYBERNIIDÆ.

Hybernia.
Rupicapraria Early Moth
Leucophæaria—Spring Usher
Aurantiaria—Scarce Umber
Marginaria (*Progemmaria*) Dotted Border
Defoliaria—Mottled Umber

Anisopteryx.
Æscularia—March Moth

LARENTIIDÆ.

Cheimatobia.
Brumata—Winter Moth
Boreata—Northern Winter Moth

Oporabia.
Dilutata—November Moth
Filigrammaria—Autumnal Moth
Autumnaria

Larentia.
Didymata—Twin-spot Carpet
Multistrigaria—Mottled Grey
Cæsiata—Grey Mountain Carpet

LARENTIIDÆ—*cont.*

Larentia—*cont.*

Flavicinctata (*Ruficinctata*) Yellow-ringed Carpet
Salicata—Striped Twin-spot Carpet
Olivata—Beech-green Carpet
Viridaria (*Pectinitaria*)—Green Carpet

Emmelesia.

Affinitata—Rivulet
Alchemillata—Small Rivulet
Albulata—Grass Rivulet
Decolorata—Sandy Carpet
Tæniata—Barred Carpet
Unifasciata—Haworth's Carpet
Minorata (*Ericetata*)—Heath Rivulet
Adæquata (*Blandiata*)—Pretty Pinion

Eupithecia.

Venosata—Netted Pug
Consignata—Pinion-spotted Pug
Linariata—Toadflax Pug
Pulchellata—Foxglove Pug
Oblongata (*Centaureata*)—Lime-speck
Succenturiata—Bordered Lime-speck
Subfulvata—Tawny-speckled Pug
Scabiosata (*Subumbrata*)—Shaded Pug
Pernotata—Guenée's Pug
Plumbeolata—Lead-coloured Pug
Isogrammaria—Haworth's Pug
Pygmæata—Marsh Pug
Helveticaria—Edinburgh Pug
Egenaria—Pauper Pug
Satyrata—Satyr Pug
Castigata—Grey Pug
Jasioneata—Jasione Pug
Trisignata—Triple-spotted Pug

Eupithecia—*cont.*

Virgaureata—Golden-rod Pug
Fraxinata—Ash-tree Pug
Extensaria—Scarce Pug
Pimpinellata—Pimpinel Pug
Valerianata—Valerian Pug
Pusillata—Dwarf Pug
Irriguata—Marbled Pug
Campanulata—Campanula Pug
Innotata—Long-winged Pug
Indigata—Ochreous Pug
Constrictata—Wild Thyme Pug
Nanata—Narrow-winged Pug
Subnotata—Plain Pug
Vulgata—Common Pug
Albipunctata—White-spotted Pug
Expallidata—Bleached Pug
Absinthiata—Wormwood Pug
Minutata—Ling Pug
Assimilata—Currant Pug
Tenuiata—Slender Pug
Subciliata—Maple Pug
Lariciata—Larch Pug
Abbreviata—Brindled Pug
Dodoneata—Oak-tree Pug
Exiguata—Mottled Pug
Ultimaria—Tamarisk Pug
Sobrinata—Juniper Pug
Togata—Cloaked Pug
Pumilata—Double-striped Pug
Coronata—V Pug
Rectangulata—Green Pug
Debiliata—Bilberry Pug

Collix.

Sparsata—Dentated Pug

Lobophora.

Sexalisata (*Sexalata*)—Small Seraphim
Halterata (*Hexapterata*)—Seraphim
Viretata—Yellow-barred Brindle

LARENTIIDÆ—*cont.*

Lobophora—*cont.*

Carpinata (*Lobulata*)—Early Tooth-striped
Polycommata—Barred Tooth-striped

Thera.

Juniperata—Juniper Carpet
Simulata—Chestnut-coloured Carpet
Variata (*Obeliscata*)—Shaded Broad-bar
Firmata—Pine Carpet

Hypsipetes.

Ruberata—Ruddy High-flier
Trifasciata (*Impluviata*)—May High-flier
Sordidata (*Elutata*)—July High-flier

Melanthia.

Bicolorata (*Rubiginata*)—Blue-bordered Carpet
Ocellata—Purple Bar
Albicillata—Beautiful Carpet

Melanippe.

Hastata—Argent and Sable
Tristata—Small Argent and Sable
Procellata—Chalk Carpet
Unangulata—Sharp-angled Carpet
Rivata—Wood Carpet
Sociata (*Subtristata*)—Common Carpet
Montanata—Silver-ground Carpet
Galiata—Galium Carpet
Fluctuata Garden Carpet

Anticlea.

Cucullata (*Sinuata*)—Royal Mantle
Rubidata—Flame
Badiata—Shoulder Stripe
Nigrofasciaria (*Derivata*)—Streamer
Berberata—Barberry Carpet

Coremia.

Munitata—Red Carpet

Coremia—*cont.*

Designata (*Propugnata*)—Flame Carpet
Ferrugata—Red Twin-spot Carpet
Unidentaria—Dark-barred Twin-spot Carpet
Quadrifasciaria—Large Twin-spot Carpet

Camptogramma.

Bilineata—Yellow Shell
Fluviata—Gem

Phibalapteryx.

Tersata—Fern
Lapidata—Slender-striped Rufous
Vittata (*Lignata*)—Oblique Carpet
Polygrammata (*Conjunctaria*)—Many-lined
Vitalbata—Small Waved Umber

Triphosa.

Dubitata—Tissue

Eucosmia.

Certata—Scarce Tissue
Undulata—Scalloped Shell

Scotosia.

Vetulata—Brown Scallop
Rhamnata—Dark Umber

Cidaria.

Siterata (*Psittacata*)—Red-green Carpet
Miata—Autumn Green Carpet
Picata—Short-cloak Carpet
Corylata—Broken-barred Carpet
Sagittata—Marsh Carpet
Truncata (*Russata*)—Common Marbled Carpet
Immanata—Dark Marbled Carpet
Suffumata—Water Carpet
Reticulata—Netted Carpet
Silaceata—Small Phœnix
Prunata (*Ribesiaria*)—Phœnix
Testata—Chevron

LARENTIIDÆ—*cont.*
Cidaria—*cont.*
Populata—Northern Spinach
Fulvata—Barred Yellow
Dotata (*Pyraliata*)—Barred Straw
Associata (*Dotata*)—Spinach
Pelurga.
Comitata—Dark Spinach
EUBOLIIDÆ.
Eubolia.
Cervinata (*Cervinaria*)—Mallow
Limitata (*Mensuraria*)—Small Mallow
Plumbaria (*Palumbaria*)—Belle
Bipunctaria—Chalk Carpet
Mesotype.
Virgata (*Lineolata*)—Oblique-striped
Carsia.
Paludata (*Imbutata*)—Manchester Treble Bar
Anaitis.
Plagiata—Treble Bar
Lithostege.
Griseata—Pale Grey Carpet
Chesias.
Spartiata—Streak
Rufata (*Obliquaria*)—Broom Tip
SIONIDÆ.
Tanagra.
Atrata (*Chærophyllata*)—Chimney Sweep

APPENDIX II

THE LEPIDOPTERIST'S CALENDAR

The success of the country rambles of an expert lepidopterist depends greatly on his knowledge of the times at which the various butterflies and moths generally appear, and of the localities which they are known to frequent. The experiences he has gained in the past enable him to calculate on the probabilities of the future, and he chooses both time and locality according to his requirements.

As he makes his way to the hunting ground he counts over the chances of meeting with a certain insect that is wanted to fill a long-standing blank in his cabinet; and we hear him discussing the probabilities as to whether this species is yet 'out,' or whether the larvæ of that species are feeding.

How different it is with the young and unguided entomologist! He rambles promiscuously here and there, having only the faintest idea as to what he is likely to see, and perhaps meeting with only four or five species when an experienced collector, without covering a larger area of ground, would take scores in the same time.

In order to afford some little help to the beginner, I have thought it advisable to introduce a calendar of operations to guide him [illegible]. The space at our command would not allow this to be [illegible] in detail, but the general instructions will no doubt [illegible] of my readers until the practical experience gained by a few years' work has enabled them to run on their own legs.

Of course, in making reference to the monthly lists of insects on the wing, allowance must be made for the forwardness or backwardness of the seasons. Thus, an insect entered in the April list *may* appear in March in an exceptionally warm season, but may not emerge till the early part of May if the spring has been unusually severe.

It will be observed that in cases where all the species of a certain genus or family appear on the wing in the same month, the name of that genus or family is entered on the list instead of the names of the individual species; but the latter can easily be obtained by reference to Appendix I.

JANUARY

There is not much field work to be done during this month. If the weather is very severe, hardly an insect will be found on the wing; but a mild January will sometimes entice the Brimstone Butterfly (*Rhamni*) and some of the hybernating Vanessas from their winter quarters.

Hybernating moths may also be met with, on the wing if the weather is mild, or sleeping in their sheltered nooks during the frosts. These include several *Noctuæ*—*Auricoma*, *Lithargyria*, *Suffusa*, *Vaccinii*, *Spadicea*, *Erythrocephala*, *Satellitia*, *Rubiginea*, *Croceago*, *Vetusta*, *Exoleta*, *Ornithopus*, *Furcifera*, *Semibrunnea*, *Socia*, and *Libatrix*; and also a few *Geometræ* — *Zonaria*, *Fluviata*, *Dubitata*, *Siterata*, and *Miata*.

In addition to these hybernating insects, the collector may examine tree trunks and fences for the Early Moth (*Rupicapraria*), and late specimens of the Winter Moth (*Brumata*); and towards the end of the month he may expect to meet with fresh specimens of the Pale Brindled Beauty (*Pedaria*) and the Spring Usher (*Leucophæaria*). A few of the *Tineæ* may also be seen.

The net need not be used at all during the colder months of the year, as the moths are easily taken in pill boxes from the trunks and fences on which they rest.

Pupa digging may be carried on throughout the month if the weather is sufficiently mild, but it is of no use attempting this during a frost. Hybernating larvæ may also be searched out of their winter quarters if the collector does not mind giving them the attention they require; but, as a rule, it is better to wait till they themselves start out to feed in the spring, at which time all their food plants are showing leaf.

FEBRUARY

Our remarks under 'January' concerning pupa digging and other work apply equally well to this month. The same hybernating butterflies and moths may be looked for; and, in addition to

Pedaria, *Leucophæaria*, and *Rupicapraria*, which now appear more plentifully, the following species will probably be seen:

Small Eggar (*Lanestris*)
Small Brindled Beauty (*Hispidaria*)
Oak Beauty (*Strataria*)
Dotted Border (*Marginaria*)
March Moth (*Æscularia*)

About half a dozen species of the *Tineæ* will also have made their appearance before the end of the month.

MARCH

Many of the hybernating larvæ will come out during March if the weather is mild, and commence to feed; and the young caterpillars will begin to appear from the eggs of the early moths already named. This is consequently a good time to commence the search for larvæ if you intend to go in for rearing. During the daytime some may be beaten from the boughs of trees and shrubs; and those which feed on low plants, being generally nocturnal in their habits, should be searched for in the evening, after dark, with the aid of a lantern.

The hybernating butterflies are now flying more freely than before, and, if the weather is bright and warm for the time of year, a few freshly emerged species may be seen. These may possibly include:

Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Holly Blue (*Argiolus*)

As regards moths, several fresh species may be expected to appear, while those named as appearing in February are still to be found. The new-comers may include:

Bombyces.
- Kentish Glory (*Versicolor*)
- Yellow-horned (*Flavicornis*)

Noctuæ.
- Pine Beauty (*Piniperda*)
- White-marked Rustic (*Leucographa*)
- Red Chestnut (*Rubricosa*)
- All species of the genus *Tæniocampa*
- Early Grey (*Areola*)

Noctuæ—*cont.*
- Green-brindled Dot (*Oleagina*)
- Orange Underwing (*Parthenias*)
- Light Orange Underwing (*Notha*)

Geometræ.
- Early Thorn (*Bilunaria*)
- Engrailed (*Biundularia*)
- Mottled Grey (*Multistrigaria*)

Sugaring may be commenced towards the end of March, and sallow blossom may be searched in the evening, but it is probable that only a few species will be taken by these means.

A few more species of the *Tineæ* appear in March, and four or five of the *Tortrices* are out before the end of the month.

APRIL

This is really a busy month with the entomologist, and it will be necessary to put all apparatus and appliances into perfect order early. The cyanide bottle should be freshly charged, nets examined and repaired if necessary, and all setting boards, breeding cages &c. put in perfect trim for the new season's work.

Larvæ are now feeding freely, and a few hours spent in beating, sweeping, and searching will enable you to stock your cages liberally.

Sugaring may be continued throughout the month, and the sallow blossom may be searched as long as it proves attractive. Moths may also be attracted by light at night.

The following butterflies are generally out during April, in addition to the hybernated species already named:

Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Orange Tip (*Cardamines*)
Wood White (*Sinapis*)
Pearl-bordered Fritillary (*Euphrosyne*)
Speckled Wood (*Egeria*)
Green Hairstreak (*Rubi*)
Small Copper (*Phlœas*)
Holly Blue (*Argiolus*)
Grizzled Skipper (*Malvæ*)
Dingy Skipper (*Tages*)

The following is a list of the principal moths for April:

Bombyces.
Small Lappet (*Ilicifolia*)
Kentish Glory (*Versicolor*)
Yellow Horned (*Flavicornis*)
Frosted Green (*Ridens*)
Noctuæ.
Pine Beauty (*Piniperda*)
White-marked Rustic (*Leucographa*)
Red Chestnut (*Rubricosa*)
All species of the genus *Tæniocampa*
Early Grey (*Areola*)
Mullein Shark (*Verbasci*)
Orange Underwing (*Parthenias*)
Light Orange Underwing (*Notha*)
Geometræ.
Brimstone (*Luteolata*)
Early Thorn (*Bilunaria*)
Belted Beauty (*Zonaria*)
Geometræ—*cont.*
Brindled Beauty (*Hirtaria*)
Waved Umber (*Abruptaria*)
Small Engrailed (*Crepuscularia*)
Engrailed (*Biundularia*)
Sloe Carpet (*Pictaria*)
Netted Mountain (*Carbonaria*)
Mottled Grey (*Multistrigaria*)
Satyr Pug (*Satyrata*)
Marbled Pug (*Irriguata*)
Campanula Pug (*Campanulata*)
Brindled Pug (*Abbreviata*)
Oak-tree Pug (*Dodoneata*)
Double-striped Pug (*Pumilata*)
Early Tooth-striped (*Carpinata*)
Shoulder Stripe (*Badiata*)
Many-lined (*Polygrammata*)
Tissue (*Dubitata*)

In addition to the above, a few species of the *Tortrices*, several of the *Tineæ*, and one or two of the Plume Moths (*Pterophori*) are out during April.

MAY

Little or nothing will be obtained by digging during May, yet a number of pupæ may be found among grass and leaves under trees, and also attached to the leaves and stems of low plants. These pupæ include those of several of the butterflies, among which may be mentioned *Machaon, Selene, Euphrosyne, Aurinia, Megæra, Ianira, Rubi, Astrarche, Icarus, Bellargus, Corydon, Lucina,* and *Sylvanus.*

Larvæ may now be taken in abundance by beating the boughs of oaks and other trees, and also by examining low plants.

The hybernating butterflies are still on the wing, and the following are also out:

Swallow Tail (*Machaon*)
Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Bath White (*Daplidice*)
Orange Tip (*Cardamines*)
Wood White (*Sinapis*)
Small Pearl-bordered (*Selene*)
Pearl-bordered (*Euphrosyne*)
Greasy Fritillary (*Aurinia*)
Glanville Fritillary (*Cinxia*)
Speckled Wood (*Egeria*)

Wall (*Megæra*)
Marsh Ringlet (*Typhon*)
Small Heath (*Pamphilus*)
Green Hairstreak (*Rubi*)
Small Copper (*Phlæas*)
Brown Argus (*Astrarche*)
Common Blue (*Icarus*)
Clifden Blue (*Bellargus*)
Holly Blue (*Argiolus*)
Mazarine Blue (*Semiargus*)
Grizzled Skipper (*Malvæ*)
Chequered Skipper (*Palæmon*)

There is a great increase in the number of moths this month, and much good work may be done by means of light traps and by the examination of fences. Many moths are driven from their resting places early in the morning by the direct rays of the rising sun, and then seek out a spot where they are better sheltered, and where they are consequently less easily found. Hence the advantage of searching fences early in the morning.

The May list includes:

Sphinges.
Small Elephant (*Porcellus*)
All species of the genera *Smerinthus* and *Macroglossa*
Some of the Clearwings (*Apiformis*, *Sphegiformis*, and *Culiciformis*)
Cream-bordered Green (*Chlorana*)
Green Silver-lines (*Prasinana*)

Bombyces.
Wood Tiger (*Plantaginis*)
Muslin Moth (*Mendica*)
Common Swift (*Lupulinus*)
Pale Tussock (*Pudibunda*)
Small Lappet (*Ilicifolia*)
Emperor (*Pavonia*)
All species of family *Drepanulidæ*
Alder Kitten (*Bicuspis*)

Bombyces—*cont.*
Puss (*Vinula*)
Several of the 'Prominents' (*Cuculla, Carmelita, Dictæa, Dictæoides, Trilophus, Ziczac, Trepida, Chaonia, Trimacula*)
Chocolate Tip (*Curtula*)
Small Chocolate Tip (*Pigra*)

Noctuæ.
Knot Grass (*Rumicis*)
Sweet Gale (*Myricæ*)
White Colon (*Albicolon*)
Cabbage (*Brassicæ*)
Treble Lines (*Trigrammica*)
Marsh Moth (*Palustris*)
Light Brocade (*Genistæ*)
Mullein Shark (*Verbasci*)
Betony Shark (*Scrophulariæ*)
Starwort Shark (*Asteris*)
Camomile Shark (*Chamomillæ*)
Small Dark Yellow Underwing (*Cordigera*)
Small Yellow Underwing (*Tenebrata*)
Bordered Sallow (*Umbra*)
Lunar Double Stripe (*Lunaris*)

Geometræ.
Brimstone (*Luteolata*)
Speckled Yellow (*Macularia*)
Purple Thorn (*Tetralunaria*)
Scalloped Hazel (*Bidentata*)
Brindled Beauty (*Hirtaria*)
Peppered (*Betularia*)
Waved Umber (*Abruptaria*)
Ringed Carpet (*Cinctaria*)
Square Spot (*Consonaria*)
Small Engrailed (*Crepuscularia*)
Engrailed (*Biundularia*)
Grey Birch (*Punctularia*)
Small Grass Emerald (*Viridata*)
All species of family *Ephyridæ*
Cream Wave (*Remutaria*)

Geometræ—*cont.*
White Wave (*Pusaria*)
Round-winged Wave (*Rotundaria*)
Common Wave (*Exanthemata*)
Clouded Silver (*Temerata*)
White-pinion Spotted (*Bimaculata*)
Latticed Heath (*Clathrata*)
Brown Silver-line (*Petraria*)
Barred Umber (*Pulveraria*)
Netted Mountain (*Carbonaria*)
Common Heath (*Atomaria*)
Bordered White (*Piniaria*)
Rest Harrow (*Ononaria*)
Yellow Belle (*Ochrearia*)
Clouded Border (*Marginata*)
Horse Chestnut (*Hippocastanaria*)
Pretty Pinion (*Adæquata*)
Pugs (*Venosata, Consignata, Pulchellata, Plumbeolata, Satyrata, Castigata, Pusillata, Irriguata, Indigata, Nanata, Vulgata, Assimilata, Exiguata, Coronata*)
Yellow-barred Brindle (*Viretata*)
Ruddy High-flier (*Ruberata*)
May High-flier (*Trifasciata*)
Common Carpet (*Sociata*)
Silver-ground Carpet (*Montanata*)
Streamer (*Nigrofasciaria*)
Barberry Carpet (*Berberata*)
Flame Carpet (*Designata*)
Twin-spot Carpets (*Ferrugata* and *Unidentaria*)
Scarce Tissue (*Certata*)
Water Carpet (*Suffumata*)
Small Phœnix (*Silaceata*)
Oblique-striped (*Virgata*)
Broom Tip (*Rufata*)

A number of the Micros are also out this month. About twenty species of the *Pyralides*, one or two of the *Pterophori*, a few *Crambi*, about fifty of the *Tortrices*, and no less than two hundred of the *Tineæ*. The collector will do well to search fences and tree trunks for these moths, whenever he has the opportunity; and also to use the net freely in wooded country, waste places, and along hedgerows, *before* and at dusk.

JUNE

There is a marked increase in winged insect life during this month. The early butterflies are disappearing, or perhaps have quite left us; but new species are taking their place. The *Sphinges* now reach their maximum, as do also the *Bombyces*; and the other groups are almost if not quite up to their highest total. The *Noctuæ* and *Geometræ* each amount to over a hundred species. No less than a hundred and fifty British *Tortrices* are on the wing; the *Tineæ* make a near approach to three hundred, and the *Pyralides* of the month are not far short of numbering a hundred species. It will thus be seen that the net and pill boxes, as well as the setting boards, are in constant demand.

Dull days may be well occupied in beating for moths, and in the examination of fences and the bark of trees; and on bright days, as soon as the butterflies have settled down to rest, the same work may be carried on till dusk.

Micros and *Geometræ* are out early in the evening, when they should be taken with the net. Later on the *Noctuæ* may be seen playing round their favourite flowers.

Sugar and light traps are likely to do good service during June, and decoy females of the *Bombyces* group may be called to your aid.

Larvæ are also abundant during June, and those of most of the butterflies may be taken by carefully searching their food plants.

The following is the list of imagines for the month:

Butterflies.

Swallow Tail (*Machaon*)
Black-veined White (*Cratægi*)
Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Small Pearl-bordered (*Selene*)
Pearl-bordered (*Euphrosyne*)
Silver-washed Fritillary (*Paphia*)
Greasy Fritillary (*Aurinia*)
Glanville .. (*Cinxia*)
Heath .. (*Athalia*)
Small Tortoiseshell (*Urticæ*)
White Admiral (*Sibylla*)
Small Ringlet (*Epiphron*)
Meadow Brown (*Janira*)
Ringlet (*Hyperanthes*)

Butterflies—*cont.*

Marsh Ringlet (*Typhon*)
Small Heath (*Pamphilus*)
Green Hairstreak (*Rubi*)
Small Copper (*Phlæas*)
Common Blue (*Icarus*)
Small Blue (*Minima*)
Duke of Burgundy (*Lucina*)
Grizzled Skipper (*Malvæ*)
Dingy Skipper (*Tages*)
Large Skipper (*Sylvanus*)
Chequered Skipper (*Palæmon*)

Sphinges.

Privet Hawk (*Ligustri*)
Spurge Hawk (*Euphorbiæ*)
Small Elephant (*Porcellus*)
Large Elephant (*Elpenor*)
Eyed Hawk (*Ocellatus*)

Sphinges—*cont.*
- Poplar Hawk (*Populi*)
- Lime Hawk (*Tiliæ*)
- Humming Bird Hawk (*Stellatarum*)
- All the Clearwings (*Sesiidæ*)
- The Burnets (Fam. *Zygænidæ*)

Bombyces.
- Family *Nolidæ*
- Dew Moth (*Irrorella*)
- Cinnabar (*Jacobææ*)
- Scarlet Tiger (*Dominula*)
- Family *Cheloniidæ*
- Family *Hepialidæ*
- Family *Cossidæ*
- Family *Cochliopodidæ*
- Dark Tussock (*Fascelina*)
- Pale Tussock (*Pudibunda*)
- Scarce Vapourer (*Gonostigma*)
- Fox (*Rubi*)
- Lappet (*Quercifolia*)
- Family *Drepanulidæ*
- Family *Dicranuridæ*
- Pale Prominent (*Palpina*)
- Coxcomb Prominent (*Camelina*)
- Swallow Prominent (*Dictæa*)
- Lesser Swallow Prominent (*Dictæoides*)
- Iron Prominent (*Dromedarius*)
- Pebble Prominent (*Ziczac*)
- Great Prominent (*Trepida*)
- Marbled Brown (*Trimacula*)
- Buff Tip (*Bucephala*)
- Peach Blossom (*Batis*)
- Genus *Cymatophora*

Noctuæ.
- Scarce Marvel-du-jour (*Orion*)
- Genus *Acronycta*
- Powdered Wainscot (*Albovenosa*)
- Most of the species of genus *Leucania*
- Flame Wainscot (*Flammea*)
- Silky Wainscot (*Maritima*)
- Small Rufous (*Rufa*)
- Mere Wainscot (*Hellmanni*)
- Concolorous (*Extrema*)

Noctuæ—*cont.*
- Flame (*Putris*)
- Genus *Xylophasia*
- Bird's Wing (*Scabriuscula*)
- Small Mottled Willow (*Exigua*)
- Bordered Gothic (*Reticulata*)
- Feathered Ear (*Leucophæa*)
- Large Nutmeg (*Sordida*)
- White Colon (*Albicolon*)
- Cabbage (*Brassicæ*)
- Dot (*Persicariæ*)
- Rustic Shoulder Knot (*Basilinea*)
- Union Rustic (*Connexa*)
- Dusky Brocade (*Gemina*)
- Double Lobed (*Ophiogramma*)
- Genus *Miana*
- Treble Lines (*Trigrammica*)
- Mottled Rustic (*Morpheus*)
- Rustic (*Taraxaci*)
- Pale Mottled Willow (*Quadripunctata*)
- Reddish Buff (*Caliginosa*)
- Marsh Moth (*Palustris*)
- Brown Rustic (*Tenebrosa*)
- Turnip (*Segetum*)
- Heart and Dart (*Exclamationis*)
- Light-feathered Rustic (*Cinerea*)
- Sand Dart (*Ripæ*)
- Garden Dart (*Nigricans*)
- Lover's Knot (*Strigula*)
- Double Dot (*Augur*)
- Flame Shoulder (*Plecta*)
- Double-spotted Square-spot (*Triangulum*)
- Ingrailed Clay (*Festiva*)
- Broad-bordered Yellow Underwing (*Fimbria*)
- Large Yellow Underwing (*Pronuba*)
- Gothic (*Typica*)
- Heart Moth (*Oo*)
- Genus *Dianthœcia*
- Broad-barred White (*Serena*)
- Small Angle Shades (*Lucipara*)

Noctuæ—*cont.*
- Angle Shades (*Meticulosa*)
- Green Arches (*Prasina*)
- Grey Arches (*Nebulosa*)
- Silvery Arches (*Tincta*)
- Pale Shining Brown (*Advena*)
- Northern Arches (*Exulis*)
- Genus *Hadena* (nearly all)
- Lychnis Shark (*Lychnitis*)
- Starwort Shark (*Asteris*)
- Cudweed Shark (*Gnaphalii*)
- Camomile Shark (*Chamomillæ*)
- Shark (*Umbratica*)
- Genus *Habrostola*
- Burnished Brass (*Chrysitis*)
- Plain Golden Y (*Iota*)
- Beautiful Golden Y (*Pulchrina*)
- Silver Y (*Gamma*)
- Scarce Silver Y (*Interrogationis*)
- Genus *Anarta*
- Small Yellow Underwing (*Tenebrata*)
- Bordered Straw (*Peltigera*)
- Bordered Sallow (*Umbra*)
- Spotted Sulphur (*Trabealis*)
- Four-spotted (*Luctuosa*)
- Family *Erastriidæ*
- Purple Marbled (*Ostrina*)
- Small Marbled (*Parva*)
- Small Purple-barred (*Viridaria*)
- Mother Shipton (*Mi*)
- Burnet Noctua (*Glyphica*)
- Black Neck (*Pastinum*)
- Family *Herminiidæ*
- Family *Hypenidæ*

Geometræ.
- Little Thorn (*Advenaria*)
- Brimstone (*Luteolata*)
- Speckled Yellow (*Macularia*)
- Orange (*Prunaria*)
- Barred Red (*Prosapiaria*)
- Scorched Wing (*Dolabraria*)
- Lunar Thorn (*Lunaria*)
- Peppered (*Betularia*)
- Speckled Beauty (*Angularia*)

Geometræ—*cont.*
- Genus *Boarmia*
- Square Spot (*Consonaria*)
- Brindled White-spot (*Luridata*)
- Grey Birch (*Punctularia*)
- Blotched Emerald (*Pustulata*)
- Small Grass Emerald (*Viridata*)
- Common Emerald (*Strigata*)
- Nearly all the family *Acidaliidæ*
- Genus *Bapta*
- Peacock (*Notata*
- Rannock Geometer (*Brunneata*)
- Brown Silver-line (*Petraria*)
- Barred Umber (*Pulveraria*)
- Grey Scalloped Bar (*Belgiaria*)
- Frosted Yellow (*Limbaria*)
- Bordered White (*Piniaria*)
- Drab Geometer (*Murinata*)
- Black-veined (*Lineata*)
- Grass Wave (*Strigillaria*)
- Clouded Magpie (*Sylvata*)
- Scorched Carpet (*Adustata*)
- Clouded Border (*Marginata*)
- Twin-spot Carpet (*Didymata*)
- Grey Mountain Carpet (*Cæsiata*)
- Striped Twin-spot Carpet (*Salicata*)
- Green Carpet (*Viridaria*)
- Genus *Emmelesia*
- Most of the Pugs (*Eupithecia*)
- Small Seraphim (*Sexalisata*)
- Seraphim (*Halterata*)
- Yellow-barred Brindle (*Viretata*)
- Shaded Broad-bar (*Variata*)
- Ruddy High-flier (*Ruberata*)
- Purple Bar (*Ocellata*)
- Beautiful Carpet (*Albicillata*)
- Genus *Melanippe*
- Royal Mantle (*Cucullata*)
- Flame (*Rubidata*)
- Genus *Coremia*
- Yellow Shell (*Bilineata*)

Geometræ—*cont.*
Fern (*Ternata*)
Oblique Carpet (*Vittata*)
Small Waved Umber (*Vitalbata*)
Scalloped Shell (*Undulata*)
Brown Scallop (*Vetulata*)
Short-cloak Carpet (*Picata*)
Broken-barred Carpet (*Corylata*)

Geometræ—*cont.*
Common Marbled Carpet (*Truncata*)
Small Phœnix (*Silaceata*)
Small Mallow (*Limitata*)
Belle (*Plumbaria*)
Oblique-striped (*Virgata*)
Treble Bar (*Plagiata*)
Pale Grey Carpet (*Griseata*)
Chimney Sweep (*Atrata*)

JULY

The number of species on the wing in July is even greater than in June. Butterflies are very numerous, some being second broods of double-brooded species, and others late single-brooded insects.

Sphinges are beginning to fall off, and so are the *Bombyces*, but the *Noctuæ* and *Geometræ* are slightly on the increase.

As regards the Micros, a good number of fresh species may be expected, all the groups exhibiting a marked increase in the total number on the wing with the exception of the *Tineæ*.

Sugaring is likely to pay well this month, and many moths may be attracted by light. Tree trunks and fences should be well examined.

Pupæ may certainly be taken, but unless the collector is particularly desirous of obtaining the pupæ of insects known to be now passing through that stage, he will probably do better by looking after imagines.

Larvæ, however, may well receive a little attention, providing the setting of butterflies and moths leave a little leisure for other employments. Beating by day, and searching by both day and night, even if carried on only occasionally, will probably supply you with as many species as you can accommodate in your glasses and cages.

The butterflies of the month are:

Swallow Tail (*Machaon*)
Black-veined White (*Cratægi*)
Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Wood White (*Sinapis*)
Brimstone (*Rhamni*)
Dark Green Fritillary (*Aglaia*)
High Brown Fritillary (*Adippe*)
Silver-washed Fritillary (*Paphia*)
Heath Fritillary (*Athalia*)
Comma (*C-Album*)

Large Tortoiseshell (*Polychloros*)
Small Tortoiseshell (*Urticæ*)
Peacock (*Io*)
Painted Lady (*Cardui*)
White Admiral (*Sibylla*)
Purple Emperor (*Iris*)
Marbled White (*Galatea*)
Northern Brown (*Æthiops*)
Speckled Wood (*Egeria*)
Grayling (*Semele*)
Meadow Brown (*Ianira*)
Large Heath (*Tithonus*)

Ringlet (*Hyperanthes*)
Marsh Ringlet (*Typhon*)
Small Heath (*Pamphilus*)
Brown Hairstreak (*Betulæ*)
White-letter Hairstreak (*W-Album*)
Dark Hairstreak (*Pruni*)
Purple Hairstreak (*Quercus*)
Green Hairstreak (*Rubi*)
Small Copper (*Phlœas*)
Silver-studded Blue (*Ægon*)
Common Blue (*Icarus*)
Chalk-hill Blue (*Corydon*)
Holly Blue (*Argiolus*)
Mazarine Blue (*Semiargus*)
Small Blue (*Minima*)
Large Blue (*Arion*)
Small Skipper (*Thaumas*)
New Small Skipper (*Lineola*)

The moths of July include the following species:

Sphinges.
Privet Hawk (*Ligustri*)
Bedstraw Hawk (*Galii*)
Eyed Hawk (*Ocellatus*)
Poplar Hawk (*Populi*)
Humming Bird Hawk (*Stellatarum*)
Hornet Clearwing of Poplar (*Apiformis*)
Hornet Clearwing of Osier (*Crabroniformis*)
Welsh Clearwing (*Scoliiformis*)
Red-belted Clearwing (*Myopiformis*)
Red-tipped Clearwing (*Formiciformis*)
Six-belted Clearwing (*Ichneumoniformis*)
Genus *Ino*
Burnets (*Trifolii*, *Loniceræ* and *Filipendulæ*)

Bombyces.
Tortrix (*Undulanus*)
Large Green Silver-lined (*Bicolorana*)
Short-cloaked (*Cucullatella*)
Most of the family *Lithosiidæ*
Tiger (*Caia*)
Ruby Tiger (*Fuliginosa*)
Buff Ermine (*Lubricipeda*)
White Ermine (*Menthastri*)
Wood Swift (*Sylvanus*)
Northern Swift (*Velleda*)
Goat Moth (*Ligniperda*)
Leopard (*Pyrina*)
Brown Tail (*Chrysorrhœa*)

Bombyces—*cont.*
Yellow Tail (*Similis*)
Satin (*Salicis*)
Reed Tussock (*Cœnosa*)
Black Arches (*Monacha*)
Vapourer (*Antiqua*)
Lackey (*Neustria*)
Ground Lackey (*Castrensis*)
Oak Eggar (*Quercus*)
Drinker (*Potatoria*)
Sallow Kitten (*Furcula*)
Poplar Kitten (*Bifida*)
Lobster (*Fagi*)
Pale Prominent (*Palpina*)
Coxcomb Prominent (*Camelina*)
Buff Tip (*Bucephala*)
Buff Arches (*Derasa*)
Peach Blossom (*Batis*)
Figure of Eighty (*Octogesima*)
Poplar Lutestring (*Or*)
Lesser Satin (*Duplaris*)

Noctuæ.
Marbled Green (*Muralis*)
Marbled Beauty (*Perla*)
Grey Dagger (*Psi*)
Miller (*Leporina*)
Poplar Grey (*Megacephala*)
Grisette (*Strigosa*)
Coronet (*Ligustri*)
Knot Grass (*Rumicis*)
Scarce Dagger (*Auricoma*)
Light Knot Grass (*Menyanthidis*)
Brown Line Bright Eye (*Conigera*)

Noctuæ—*cont.*

- Double Line (*Turca*)
- Clay (*Lithargyria*)
- Wainscots (*Littoralis, Impudens, Comma, Impura, Pallens, Phragmitidis, Maritima, Rufa, Bondii, Neurica*)
- Ear Moth (*Nictitans*)
- Flame (*Putris*)
- Genus *Xylophasia*
- Antler (*Graminis*)
- Straw Underwing (*Matura*)
- Most of Genus *Mamestra*
- Genus *Miana*
- Haworth's Minor (*Haworthii*)
- Treble Lines (*Trigrammica*)
- Genus *Caradrina*
- Brown Rustic (*Tenebrosa*)
- Archer's Dart (*Vestigialis*)
- Pearly Underwing (*Saucia*)
- Heart and Dart (*Exclamationis*)
- Heart and Club (*Corticea*)
- Sand Dart (*Ripæ*)
- Coast Dart (*Cursoria*)
- Garden Dart (*Nigricans*)
- Streaked Dart (*Aquilina*)
- True Lover's Knot (*Strigula*)
- Stout Dart (*Obscura*)
- Dotted Rustic (*Simulans*)
- Northern Rustic (*Lucernea*)
- Ashworth's Rustic (*Ashworthii*)
- Most of Genus *Noctua*
- Genus *Triphæna*
- Copper Underwing (*Pyramidea*)
- Mouse (*Tragopogonis*)
- Old Lady (*Maura*)
- Suspected (*Suspecta*)
- Dismal (*Upsilon*)
- Olive (*Subtusa*)
- Genus *Calymnia*
- Dusky Sallow (*Ochroleuca*)
- Marbled Coronet (*Nana*)
- Genus *Hecatera*
- Minor Shoulder Knot (*Viminalis*)
- Small Angle Shades (*Lucipara*)

Noctuæ—*cont.*

- Genus *Aplecta*
- Dark Brocade (*Adusta*)
- Shears (*Dentina*)
- Nutmeg (*Trifolii*)
- Pale-shouldered Brocade (*Thalassina*)
- Silver Cloud (*Conspicillaris*)
- Lychnis Shark (*Lychnitis*)
- Wormwood Shark (*Absinthii*)
- Family *Plusiidæ*
- Beautiful Yellow Underwing (*Myrtilli*)
- Marbled Clover (*Dipsacea*)
- Four-spotted (*Luctuosa*)
- Rosy Marbled (*Venustula*)
- Marbled White-spot (*Fasciana*)
- Small Purple-barred (*Viridaria*)
- Red Underwing (*Nupta*)
- Light Crimson Underwing (*Promissa*)
- Dark Crimson Underwing (*Sponsa*)
- New Black-neck (*Craccæ*)
- Family *Herminiidæ*
- Family *Hypenidæ*

Geometræ.

- Swallow-tail (*Sambucaria*)
- Dark-bordered Beauty (*Parallelaria*)
- Bordered Beauty (*Apiciaria*)
- Orange (*Prunaria*)
- Light Emerald (*Margaritaria*)
- Barred Red (*Prosapiaria*)
- Lilac Beauty (*Syringaria*)
- Early Thorn (*Bilunaria*)
- Scalloped Oak (*Elinguaria*)
- Genus *Cleora*
- Genus *Boarmia*
- Annulet (*Obscuraria*)
- Scotch Annulet (*Obfuscaria*)
- Black Mountain Moth (*Coracina*)
- Family *Geometridæ*
- Golden-bordered Purple (*Muricata*)
- Waved Carpet (*Sylvata*)

Noctuæ—*cont.*
Dingy Shell (*Obliterata*)
Welsh Wave (*Cambrica*)
Most of the *Acidaliæ*
Blood Vein (*Amataria*)
Family *Macariidæ*
Latticed Heath (*Clathrata*)
Bordered Grey (*Ericetaria*)
Common Heath (*Atomaria*)
Rest Harrow (*Ononaria*)
Vestal (*Sacraria*)
Grass Wave (*Strigillaria*)
Family *Zerenidæ*
Twin-spot Carpet (*Didymata*)
Grey Mountain Carpet (*Cæsiata*)
Yellow-ringed Carpet (*Flavicinctata*)
Beech-green Carpet (*Olivata*)
Green Carpet (*Viridaria*)
Genus *Emmelesia*
Pugs (*Linariata, Oblongata, Succenturiata, Pernotata, Isogrammaria, Virgaureata, Innotata, Subnotata, Absinthiata, Tenuiata, Subciliata, Rectangulata*)
Chestnut-coloured Carpet (*Simulata*)
Shaded Broad Bar (*Variata*)
Pine Carpet (*Firmata*)
July High-flier (*Sordidata*)
Genus *Melanthia*
Genus *Melanippe*

Noctuæ—*cont.*
Flame (*Rubidata*)
Red Carpet (*Munitata*)
Large Twin-spot Carpet (*Quadrifasciaria*)
Yellow Shell (*Bilineata*)
Fern (*Tersata*)
Oblique Carpet (*Vittata*)
Many-lined (*Polygrammata*)
Dark Umber (*Rhamnata*)
Short-cloak Carpet (*Picata*)
Marsh Carpet (*Sagittata*)
Common Marbled Carpet (*Truncata*)
Dark Marbled Carpet (*Immanata*)
Netted Carpet (*Reticulata*)
Phœnix (*Prunata*)
Chevron (*Testata*)
Northern Spinach (*Populata*)
Barred Yellow (*Fulvata*)
Barred Straw (*Dotata*)
Spinach (*Associata*)
Dark Spinach (*Comitata*)
Small Mallow (*Limitata*)
Belle (*Plumbaria*)
Chalk Carpet (*Bipunctaria*)
Oblique-striped (*Virgata*)
Manchester Treble Bar (*Paludata*)
Treble Bar (*Plagiata*)
Pale Grey Carpet (*Griseata*)
Chimney Sweep (*Atrata*)

AUGUST

Although there is a very appreciable falling off in the number of species on the wing during August, yet there remains plenty of work for the lepidopterist.

Many of the butterflies of July continue to fly during the whole or part of this month, and several fresh species commence their flight. August, too, may be looked upon as *the* month for second broods, and an opportunity now arises for searching for some of the species that were missed at the time of their early appearance in May. Clover and lucerne fields should be well worked.

A few *Sphinges* and a number of the *Bombyces* are still on the wing. The *Noctuæ* are on the decrease, but there are yet nearly a hundred species, including the rarer ones, at large.

These last may be taken at sugar in considerable numbers, and it is interesting to note that two of the Vanessas (*Atalanta* and *Cardui*) may be caught sipping on your baited trees during the daytime.

Geometræ and Micros fall off very considerably this month, but these, as well as moths of the other groups, may be taken from tree trunks and palings. Light traps may also be used with much success during August.

Fallen fruits should be examined for the larvæ that feed within them; and late in the month ripe fruit will supply food to the lovers of sweets.

Ivy blossom should be well worked at night; and clover and lucerne fields form admirable hunting grounds for moths at night, especially just after rain.

Larvæ are to be obtained in abundance by beating and searching, the latter process being conducted by night as well as by day.

The following is the list of imagines for August:

Butterflies.

Swallow Tail (*Machaon*)
Large White (*Brassicæ*)
Small White (*Rapæ*)
Green-veined White (*Napi*)
Bath White (*Daplidice*)
Wood White (*Sinapis*)
Pale Clouded Yellow (*Hyale*)
Clouded Yellow (*Edusa*)
Brimstone (*Rhamni*)
Queen of Spain (*Latona*)
Dark Green Fritillary (*Aglaia*)
High Brown Fritillary (*Adippe*)
Silver-washed Fritillary (*Paphia*)
Genus *Vanessa*
White Admiral (*Sibylla*)
Purple Emperor (*Iris*)
Marbled White (*Galatea*)
Northern Brown (*Æthiops*)
Speckled Wood (*Egeria*)
Wall (*Megæra*)
Grayling (*Semele*)
Meadow Brown (*Janira*)
Large Heath (*Tithonus*)
Small Heath (*Pamphilus*)
Brown Hairstreak (*Betulæ*)
Purple Hairstreak (*Quercus*)
Small Copper (*Phlœas*)
Tailed Blue (*Bætica*)

Butterflies—*cont.*

Silver-studded Blue (*Ægon*)
Brown Argus (*Astrarche*)
Common Blue (*Icarus*)
Clifden Blue (*Bellargus*)
Chalk-hill Blue (*Corydon*)
Holly Blue (*Argiolus*)
Mazarine Blue (*Semiargus*)
Dingy Skipper (*Tages*)
New Small Skipper (*Lineola*)
Lulworth Skipper (*Actæon*)
Large Skipper (*Sylvanus*)
Silver-spotted Skipper (*Comma*)

Sphinges.

Death's-head Hawk (*Atropos*)
Convolvulus Hawk (*Convolvuli*)
Bedstraw Hawk (*Galii*)
Striped Hawk (*Livornica*)
Humming Bird Hawk (*Stellatarum*)
Red-tipped Clearwing (*Formiciformis*)
Six-belted Clearwing (*Ichneumoniformis*)

Bombyces.

Round-winged Muslin (*Senex*)
Muslin (*Mundana*)
Footmen (*Muscerda*, *Lutarella*, *Griseola*)
Wood Swift (*Sylvanus*)

Bombyces—*cont.*
- Brown Tail (*Chrysorrhœa*)
- Yellow Tail (*Similis*)
- Satin (*Salicis*)
- Gipsy (*Dispar*)
- Black Arches (*Monacha*)
- Vapourer (*Antiqua*)
- Lackey (*Neustria*)
- Ground Lackey (*Castrensis*)
- Oak Eggar (*Quercus*)
- Grass Eggar (*Trifolii*)
- Drinker (*Potatoria*)
- Hook Tips (*Lacertinaria, Falcataria, Binaria, Cultraria*)
- Chinese Character (*Glaucata*)
- Sallow Kitten (*Furcula*)
- Poplar Kitten (*Bifida*)
- Prominents (*Camelina, Trilophus, Ziczac*)
- Lesser Lutestring (*Diluta*)

Noctuæ.
- Marbled Green (*Muralis*)
- Marbled Beauty (*Perla*)
- Grey Dagger (*Psi*)
- Scarce Dagger (*Auricoma*)
- Wainscots (*Musculosa, Albipuncta, Impura, Pallens, Fulva, Cannæ, Arundinis, Geminipuncta, Neurica, Lutosa*)
- Frosted Orange (*Ochracea*)
- Genus *Hydrœcia*
- Slender Clouded Brindle (*Scolopacina*)
- Feathered Brindle (*Australis*)
- Feathered Gothic (*Popularis*)
- Antler (*Graminis*)
- Straw Underwing (*Matura*)
- Genus *Luperina*
- Confused (*Furva*)
- Small Clouded Brindle (*Unanimis*)
- Crescent (*Leucostigma*)
- Common Rustic (*Didyma*)
- [illegible]
- Marbled Rustic ([illegible])
- Large Marbled W[illegible] ([illegible])

Noctuæ—*cont.*
- Archer's Dart (*Vestigialis*)
- Shuttle-shaped Dart (*Puta*)
- Pearly Underwing (*Saucia*)
- Crescent Dart (*Lunigera*)
- Heart and Dart (*Exclamationis*)
- Coast Dart (*Cursoria*)
- Garden Dart (*Nigricans*)
- White-line Dart (*Tritici*)
- Streaked Dart (*Aquilina*)
- Square-spot Dart (*Obelisca*)
- Heath Rustic (*Agathina*)
- Portland (*Præcox*)
- Stout Dart (*Obscura*)
- Dotted Rustic (*Simulans*)
- Plain Clay (*Depuncta*)
- Setaceous Hebrew Character (*C-Nigrum*)
- Barred Chestnut (*Dahlii*)
- Small Square-spot (*Rubi*)
- Six-striped Rustic (*Umbrosa*)
- Grey Rustic (*Castanea*)
- Square-spot Rustic (*Xanthographa*)
- Genus *Triphæna*
- Mouse (*Tragopogonis*)
- Old Lady (*Maura*)
- Mountain Rustic (*Hyperborea*)
- Suspected (*Suspecta*)
- Olive (*Subtusa*)
- Double Kidney (*Retusa*)
- Angle-striped Sallow (*Paleacea*)
- Genus *Calymnia*
- Dusky Sallow (*Ochroleuca*)
- Grey Chi (*Chi*)
- Large Ranunculus (*Flavicincta*)
- Feathered Ranunculus (*Lichenea*)
- Crescent (*Bimaculosa*)
- Great Brocade (*Occulta*)
- Beautiful Brocade (*Porphyrea*)
- Golden-rod Brindled (*Solidaginis*)
- [illegible]
- Scarce Burnished Brass (*Chryson*)

Noctuæ—*cont.*
Burnished Brass (*Chrysitis*)
Gold Spot (*Festucæ*)
Scarce Bordered Straw (*Armigera*)
Four-spotted (*Luctuosa*)
Clifden Nonpareil (*Fraxini*)
Red Underwing (*Nupta*)
Dark Crimson Underwing (*Sponsa*)

Geometræ.
Dark-bordered Beauty (*Parallelaria*)
Bordered Beauty (*Apiciaria*)
Purple Thorn (*Tetralunaria*)
Scalloped Oak (*Elinguaria*)
Canary-shouldered Thorn (*Alniaria*)
Dusky Thorn (*Fuscantaria*)
September Thorn (*Erosaria*)
August Thorn (*Quercinaria*)
Dotted Carpet (*Glabraria*)
Annulet (*Obscuraria*)
Scotch Annulet (*Obfuscaria*)
Family *Ephyridæ*
Small Dusty Wave (*Virgularia*)
Mullein Wave (*Marginepunctata*)
Small Blood Vein (*Imitaria*)
Common White Wave (*Pusaria*)
Vestal (*Sacraria*)

Geometræ—*cont.*
Yellow Belle (*Ochrearia*)
Straw Belle (*Gilvaria*)
Currant (*Grossulariata*)
Autumnaria
Haworth's Carpet (*Unifasciata*)
Bordered Lime Speck (*Succenturiata*)
Pugs (*Virgaureata, Campanulata, Indigata, Constrictata, Expallidata, Sobrinata, Variata*)
July High Flier (*Sordidata*)
Carpets (*Bicolorata, Montanata, Fluctuata, Berberata*)
Yellow Shell (*Bilineata*)
Gem (*Fluviata*)
Oblique Carpet (*Vittata*)
Many-lined (*Polygrammata*)
Tissue (*Dubitata*)
Common Marbled Carpet (*Truncata*)
Phœnix (*Prunata*)
Chevron (*Testata*)
Northern Spinach (*Populata*)
Barred Yellow (*Fulvata*)
Barred Straw (*Dotata*)
Small Mallow (*Limitata*)
Chalk Carpet (*Bipunctaria*)
Treble Bar (*Plagiata*)
Broom Tip (*Rufata*)

SEPTEMBER

THE number of species on the wing is now considerably lower, yet there is a good deal to be done both with butterflies and moths.

Many of the former are worn and ragged, but good fresh specimens of some species may be taken. Clover and lucerne fields and the flowery borders of corn fields remain very attractive.

Tree trunks and palings should be searched as before. Sugar still attracts numbers of the *Noctuæ*; and ivy blossom should be examined at night whenever an opportunity offers itself.

September is a good month for larva hunting. Most of the species that pupate in the autumn are now full fed, and will undergo the change to the chrysalis state shortly after they have been housed, thus giving but little trouble to the entomologist. The day feeders may be beaten or swept from their food plants, but, of course, the nocturnal species are best discovered by searching at night.

Some have already 'gone down' for the winter, and, consequently, pupa hunting may be started. However, as there is yet much to be done with imagines and larvæ, it may, perhaps, be better to leave the pupæ alone till about the end of the month, especially as many of the larvæ have not yet had time to complete their transformation.

The list of imagines for September includes:

Butterflies.
Clouded Yellow (*Edusa*)
Brimstone (*Rhamni*)
Queen of Spain (*Latona*)
Comma (*C-Album*)
Large Tortoiseshell (*Polychloros*)
Small Tortoiseshell (*Urticæ*)
Peacock (*Io*)
Camberwell Beauty (*Antiopa*)
Red Admiral (*Atalanta*)
Painted Lady (*Cardui*)
Speckled Wood (*Egeria*)
Wall (*Megæra*)
Grayling (*Semele*)
Large Heath (*Tithonus*)
Small Heath (*Pamphilus*)
Small Copper (*Phlœas*)
Common Blue (*Icarus*)
Clifden Blue (*Bellargus*)
Chalk-hill Blue (*Corydon*)
Holly Blue (*Argiolus*)

Sphinges.
Death's-head Hawk (*Atropos*)
Convolvulus Hawk (*Convolvuli*)
Humming Bird Hawk (*Stellatarum*)

Bombyces.
Tortrix (*Undulanus*)
Crimson Speckled (*Pulchella*)
Vapourer (*Antiqua*)
Pale Oak Eggar (*Cratægi*)
Lesser Lutestring (*Diluta*)

Noctuæ.
Figure of Eight (*Cæruleocephala*)
Small Wainscot (*Fulva*)
Bullrush (*Arundinis*)

Noctuæ—*cont.*
Large Wainscot (*Lutosa*)
Frosted Orange (*Ochracea*)
Rosy Rustic (*Micacea*)
Feathered Brindle (*Australis*)
Beautiful Gothic (*Hispidus*)
Antler (*Graminis*)
Flounced Rustic (*Testacea*)
Hedge Rustic (*Cespitis*)
Haworth's Minor (*Haworthii*)
Anomalous (*Anomala*)
Shuttle-shaped Dart (*Puta*)
Dark Sword Grass (*Suffusa*)
Pearly Underwing (*Saucia*)
Turnip (*Segetum*)
Heart and Dart (*Exclamationis*)
Autumn Rustic (*Glareosa*)
Mouse (*Tragopogonis*)
Red-lined Quaker (*Lota*)
Yellow-lined Quaker (*Macilenta*)
Genus *Anchocelis*
Genus *Xanthia*
Centre-barred Sallow (*Xerampelina*)
Double Kidney (*Retusa*)
Genus *Polia*
Black Rustic (*Nigra*)
Green-brindled Crescent (*Oxyacanthæ*)
Marvel-du-jour (*Aprilina*)
Angle Shades (*Meticulosa*)
Flame Brocade (*Flammea*)
Brindled Green (*Protea*)
Genus *Calocampa*
Genus *Xylina*
Herald (*Libatrix*)
Gold Spot (*Festucæ*)

Noctuæ—*cont.*
Silver Y (*Gamma*)
Scarce Bordered Straw (*Armigera*)
Clifden Nonpareil (*Fraxini*)
Buttoned Snout (*Rostralis*)

Geometræ.
Bordered Beauty (*Apiciaria*)
Brimstone (*Luteolata*)
Genus *Eugonia*
November (*Dilutata*)
Autumnal (*Filigrammaria*)

Geometræ—*cont.*
Juniper Pug (*Sobrinata*)
Shaded Broad Bar (*Variata*)
Slender-striped Rufous (*Lapidata*)
Tissue (*Dubitata*)
Carpets (*Siderata*, *Miata*, *Immanata*)
Chevron (*Testata*)
Mallow (*Cervinata*)
Streak (*Spartiata*)

OCTOBER

As there is very little winged life this month, and the larvæ have nearly all sought out their winter quarters, special attention may be given to pupæ. The earlier this work is started after the insects have completed their change the better. If left late, many pupæ will have been destroyed by floods, moles, &c., and a prolonged series of frosty days may render digging unproductive if not impossible. Again, it must be remembered that some larvæ are not yet down, and by digging at the roots of the trees on which they are feeding, you are preparing an acceptable bed for the late species, for the pupæ of which you may call again in about a month.

Larvæ may be obtained by beating and searching as before, but this work should be done as early in the month as possible, since but few are feeding after the first week or so.

Butterfly catching is now practically over, only a few of the late species and the hybernators being on the wing, and these only on mild days.

Noctuæ are still attracted by sugar and ivy blossom, and a few may be found at rest. *Geometræ* and Micros may be taken from palings and tree trunks by day, or caught flying at dusk.

The imagines of October may include the following butterflies:

Brimstone (*Rhamni*)
Pale Clouded Yellow (*Hyale*)
Clouded Yellow (*Edusa*)
Comma (*C-Album*)
Large Tortoiseshell (*Polychloros*)
And a few late 'Blues.'

Small Tortoiseshell (*Urticæ*)
Peacock (*Io*)
Camberwell Beauty (*Antiopa*)
Red Admiral (*Atalanta*)
Painted Lady (*Cardui*)
Small Copper (*Phlæas*)

The principal moths of the month are:

Sphinges.
Death's-head Hawk (*Atropos*)

Bombyces.
Plumed Prominent (*Plumigera*)

Noctuæ.
Large Wainscot (*Lutosa*)
Red-lined Quaker (*Lota*)
Yellow-lined Quaker (*Macilenta*)

Noctuæ—*cont.*
Beaded Chestnut (*Pistacina*)
Brown-spot Pinion (*Litura*)
Chestnut (*Vaccinii*)
Dark Chestnut (*Spadicea*)
Red-headed Chestnut (*Erythrocephala*)
Satellite (*Satellitia*)
Dotted Chestnut (*Rubiginea*)
Orange Upperwing (*Croceago*)
Brick (*Circellaris*)
Brindled Ochre (*Templi*)
Green Brindled Crescent (*Oxyacanthæ*)
Marvel-du-jour (*Aprilina*)
Angle Shades (*Meticulosa*)
Flame Brocade (*Flammea*)
Red Sword-grass (*Vetusta*)

Noctuæ—*cont.*
Sword-grass (*Exolita*)
Genus *Xylina*
Sprawler (*Sphinx*)
Silver Y (*Gamma*)

Geometræ.
Feathered Thorn (*Pennaria*)
Vestal (*Sacraria*)
Scarce Umber (*Aurantiaria*)
Mottled Umber (*Defoliaria*)
Winter (*Brumata*)
Northern Winter (*Boreata*)
November (*Dilutata*)
Juniper Carpet (*Juniperata*)
Gem (*Fluviata*)
Carpets (*Siderata*, *Miata*)
Mallow (*Cervinata*)
Streak (*Spartiata*)

NOVEMBER

No butterflies are to be seen this month with the exception of the hybernating species, and even these will not venture on the wing unless the weather is mild and bright for the season.

Most of the moths met with are also hybernators, but a few species are to be found only at this season, and these should be looked for on fences and tree trunks. A few *Noctuæ* may be taken at sugar, and the *Geometræ* attracted by lights.

The only larvæ now existing are hybernators, and many of these may be met with during your pupa-digging operations; but they are best left alone till the spring, as a rule.

The chief work of the entomologist in November is certainly pupa hunting, and this may be carried on in real earnest whenever the weather is favourable, following the instructions given in Chapter VII.

It will be remembered, also, that many of the *Lepidoptera* pass the winter in the egg state, and search may be made for ova when time permits.

The November list, besides some of the hybernating species previously mentioned, include:

Bombyces.
December (*Populi*)

Noctuæ.
Genus *Cerastis*
Satellite (*Satellitia*)
Dotted Chestnut (*Rubiginea*)
Orange Upperwing (*Croceago*)
Brindled Ochre (*Exempli*)

Geometræ.
Feathered Thorn (*Pennaria*)
Scarce Umber (*Aurantiaria*)
Mottled Umber (*Defoliaria*)
Winter (*Brumata*)
Northern Winter (*Boreata*)

DECEMBER

Outdoor work is now at a minimum. The weather is too severe, as a rule, to allow pupa digging to be carried on with either success or comfort, but favourable opportunities should be seized for this employment as well as for ova collecting.

Now and again we may meet with *P. Populi* at rest by day, or fluttering round a light at night. *Brumata* and *Defoliaria* may also be seen, and the Early Moth (*Rupicapraria*) may appear on the wing before the new year; but nothing is likely to be met with beyond these save the hybernators, already named in other lists, and some of the *Tineæ*.

It is a good plan to utilise your spare time during the dreary months of winter by attending to your cabinet. Rearrange your specimens where necessary, and see that all are properly labelled; remove all greasy specimens, and deal with them as recommended on page 127; also renew the supply of camphor or naphthaline in your drawers and store boxes. Time may also be found for the construction of apparatus that is likely to be required next season, and for repairing any that has been damaged during the work of the last.

COLOURED PLATES

Plate I (*Frontispiece*)

1. Swallow-tail (*Papilio Machaon*).
2. Black-veined White (*Aporia Cratægi*).
3. Large White (*Pieris Brassicæ*). Female.
4. Small White (*Pieris Rapæ*). Male.
5. Green-veined White (*Pieris Napi*). Under side.
6. Bath White (*Pieris Daplidice*). Female.
7. Orange Tip (*Euchloë Cardamines*). Male.
8. „ „ Male. Under side.

Plate II

1. Wood White (*Leucophasia Sinapis*).
2. Pale Clouded Yellow (*Colias Hyale*).
3. Clouded Yellow (*Colias Edusa*). Male.
4. Brimstone (*Gonopteryx Rhamni*). Male.
5. Small Pearl-bordered Fritillary (*Argynnis Selene*).
6. Pearl-bordered Fritillary (*Argynnis Euphrosyne*).
7. Queen of Spain Fritillary (*Argynnis Latona*).
8. Dark-green Fritillary (*Argynnis Aglaia*).

Plate III

1. High Brown Fritillary (*Argynnis Adippe*). Under side.
2. Silver-washed Fritillary (*Argynnis Paphia*).
3. Greasy Fritillary (*Melitæa Aurinia*).
4. Glanville Fritillary (*Melitæa Cinxia*).
5. Heath Fritillary (*Melitæa Athalia*).
6. „ „ „ „ Under side.
7. Comma (*Vanessa C-Album*).
8. Large Tortoiseshell (*Vanessa Polychloros*).
9. Small Tortoiseshell (*Vanessa Urticæ*).

Plate IV

1. Peacock (*Vanessa Io*).
2. Camberwell Beauty (*Vanessa Antiopa*).
3. Red Admiral (*Vanessa Atalanta*).
4. Painted Lady (*Vanessa Cardui*).
5. White Admiral (*Limenitis Sibylla*).

Plate V

1. Purple Emperor (*Apatura Iris*). Male.
2. Marbled White (*Melanargia Galatea*).
3. Small Ringlet (*Erebia Epiphron*).
4. Northern Brown (*Erebia Æthiops*).
5. Wood Argus (*Pararge Egeria*).
6. Wall Butterfly (*Pararge Megæra*).
7. Grayling (*Satyrus Semele*). Female.
8. Meadow Brown (*Epinephele Ianira*). Female.
9. Large Heath (*Epinephele Tithonus*). Male.
10. Ringlet (*Epinephele Hyperanthus*).

Plate VI

1. **Marsh Ringlet (*Cœnonympha Typhon*).**
2. **Small Heath (*Cœnonympha Pamphilus*).**
3. **Brown Hairstreak (*Thecla Betulæ*). Under side.**
4. **White-letter Hairstreak (*Thecla W-album*). Under side.**
5. **Dark Hairstreak (*Thecla Pruni*). Under side.**
6. **Purple Hairstreak (*Thecla Quercus*). Under side.**
7. **Green Hairstreak (*Thecla Rubi*). Under side.**
8. **Large Copper (*Polyommatus Dispar*). Male.**
9. **Small Copper (*Polyommatus Phlæas*).**
10. **Tailed Blue (*Lycæna Bætica*).**
11. Silver-studded Blue (*Lycæna Ægon*). Male.
12. ,, ,, Female.
13. Brown Argus (*Lycæna Astrarche*).
14. ,, ,, Under side.
15. Common Blue (*Lycæna Icarus*). Male.
16. ,, ,, Female.
17. Clifden Blue (*Lycæna Bellargus*). Male.
18. ,, ,, Female.

Plate VII

1. Chalk-hill Blue (*Lycæna Corydon*). Male.
2. „ „ „ „ Female.
3. Holly Blue (*Lycæna Argiolus*). Male.
4. „ „ „ „ Female.
5. Mazarine Blue (*Lycæna Semiargus*). Male.
6. „ „ „ „ Female.
7. Small Blue (*Lycæna Minima*)
8. Large Blue (*Lycæna Arion*).
9. Duke of Burgundy Fritillary (*Nemeobius Lucina*).
10. „ „ „ „ „ Under side.
11. Grizzled Skipper (*Syrichthus Malvæ*).
12. Dingy Skipper (*Nisoniades Tages*).
13. Small Skipper (*Hesperia Thaumas*).
14. Lulworth Skipper (*Hesperia Actæon*). Male.
15. Large Skipper (*Hesperia Sylvanus*). Male.
16. Silver-spotted Skipper (*Hesperia Comma*).
17. Chequered Skipper (*Carterocephalus Palæmon*).
18. New Small Skipper (*Hesperia Lineola*).

Plate VIII

1. Larva of Swallow-tail Butterfly (*Papilio Machaon*).
2. Larva of Orange Tip (*Euchloë Cardamines*).
3. Larva of Silver-washed Fritillary (*Argynnis Paphia*).
4. Larva of Peacock Butterfly (*Vanessa Io*).
5. Larva of Purple Emperor (*Apatura Iris*).
6. Larva of Duke of Burgundy Fritillary (*Nemeobius Lucina*).
7. Pupa of Swallow-tail Butterfly (*Papilio Machaon*).
8. Pupa of Orange Tip (*Euchloë Cardamines*).
9. Pupa of Silver-washed Fritillary (*Argynnis Paphia*).
10. Pupa of Purple Emperor (*Apatura Iris*).
11. Pupa of Duke of Burgundy Fritillary (*Nemeobius Lucina*)
12. Pupa of Dingy Skipper (*Nisoniades Tages*)

PLATE IX

1. Privet Hawk Moth (*Sphinx Ligustri*).
2. Spurge Hawk (*Deilephila Euphorbiæ*).
3. Large Elephant Hawk (*Chærocampa Elpenor*).
4. Eyed Hawk (*Smerinthus Ocellatus*).
5. Lime Hawk (*Smerinthus Tiliæ*).
6. Humming-bird Hawk (*Macroglossa Stellatarum*).
7. Broad-bordered Five-spotted Burnet (*Zygæna Trifolii*).

PLATE X

1. Cinnabar Moth (*Euchelia Jacobææ*).
2. Wood Tiger (*Nemeophila Plantaginis*).
3. Tiger (*Arctia Caia*).
4. Cream-spot Tiger (*Arctia Villica*).
5. Oak Eggar (*Bombyx Quercus*). Male.
6. Lappet (*Lasiocampa Quercifolia*).
7. Kentish Glory (*Endromis Versicolor*). Male
8. Emperor Moth (*Saturnia Pavonia*). Male.
9. Buff Tip (*Phalera Bucephala*).

PLATE XI

1. Large Yellow Underwing (*Triphæna Pronuba*).
2. Marvel-du-jour (*Agriopis Aprilina*).
3. Small Angle Shades (*Euplexia Lucipara*).
4. Mother Shipton (*Euclidia Mi*).
5. Clifden Nonpareil (*Catocala Fraxini*).
6. Dark Crimson Underwing (*Catocala Sponsa*).

PLATE XII

1. Herald (*Gonoptera Libatrix*).
2. Swallow-tail Moth (*Uropteryx Sambucaria*).
3. Brimstone Moth (*Rumia Luteolata*).
4. Scalloped Oak (*Crocallis Elinguaria*).
5. Brindled Beauty (*Biston Hirtaria*).
6. Waved Umber (*Hemerophila Abruptaria*).
7. Maiden's Blush (*Zonosoma Punctaria*).
8. Mottled Umber (*Hybernia Defoliaria*).
9. Treble Bar (*Anaitis Plagiata*).

Plate II

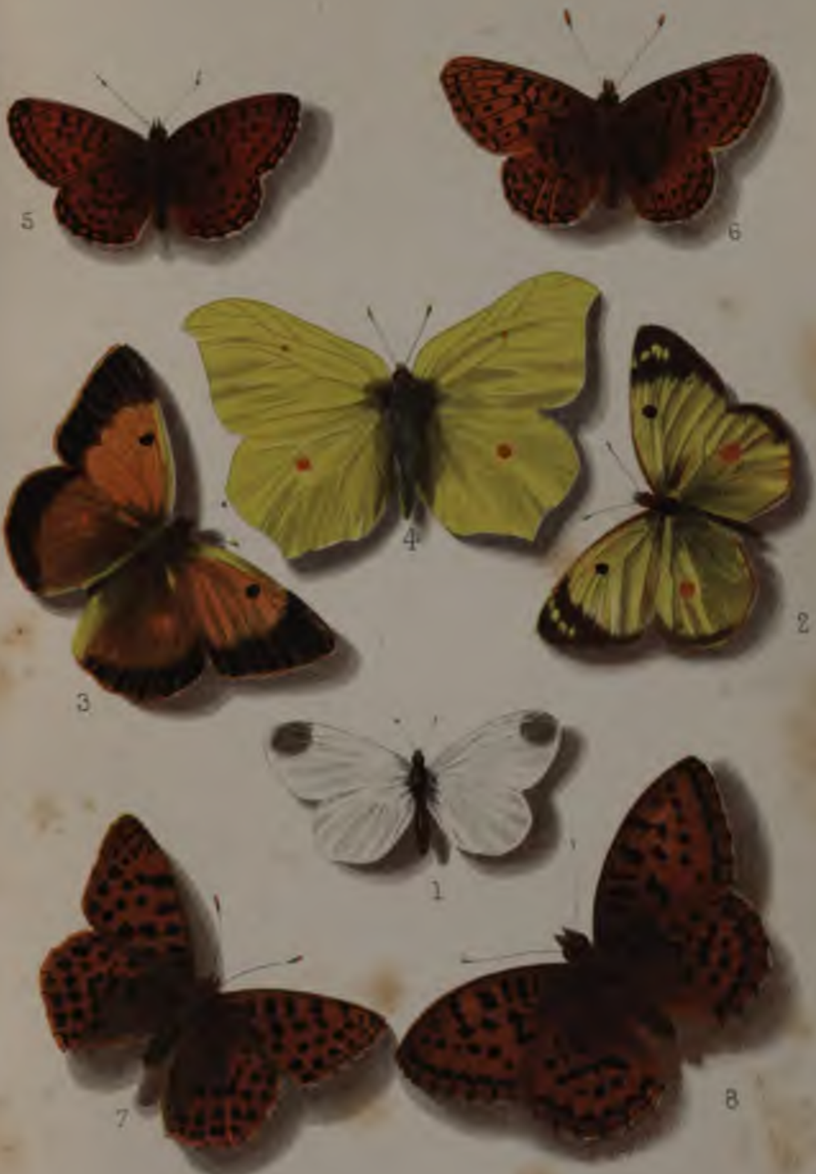


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Plate III.

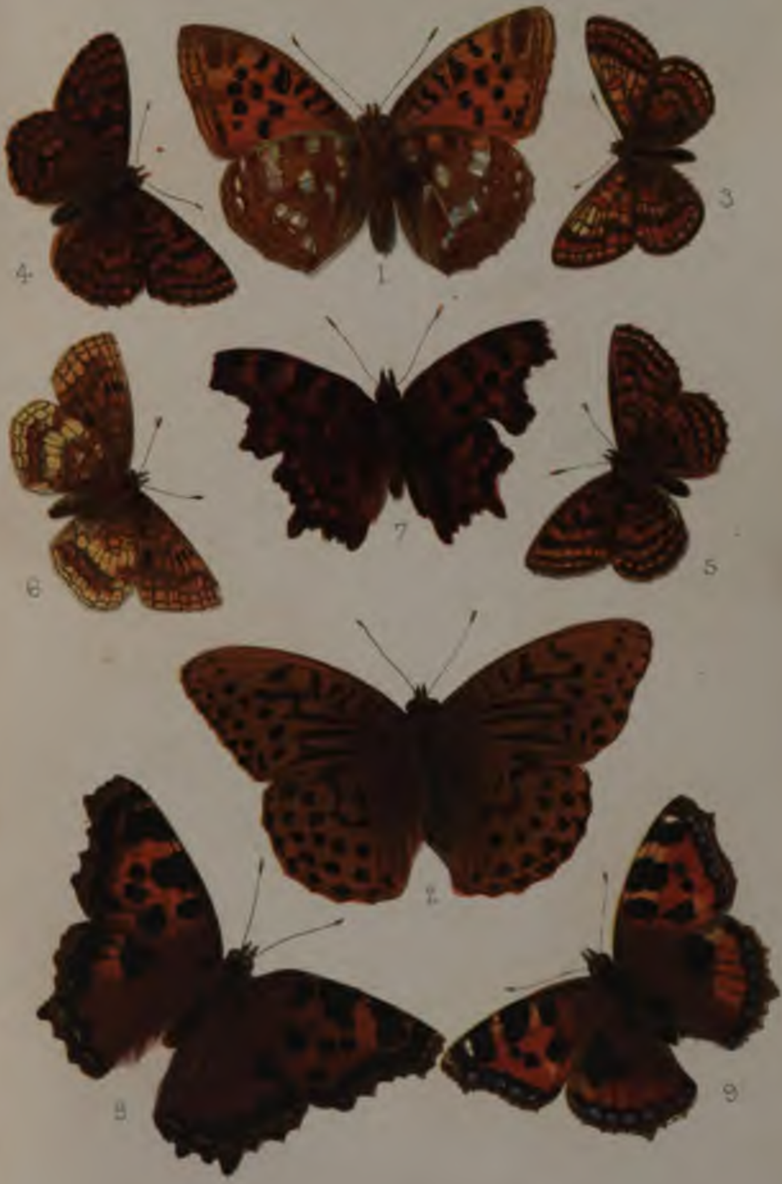

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Plate IV

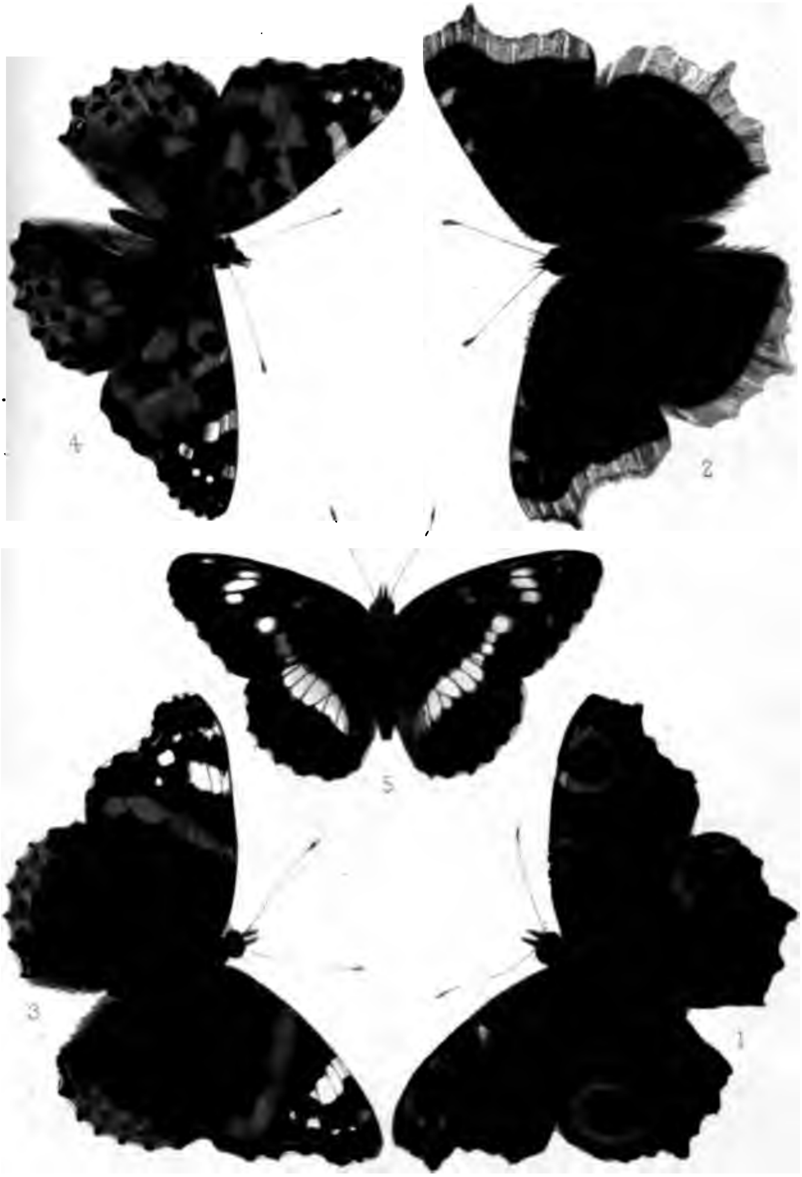

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Plate V.

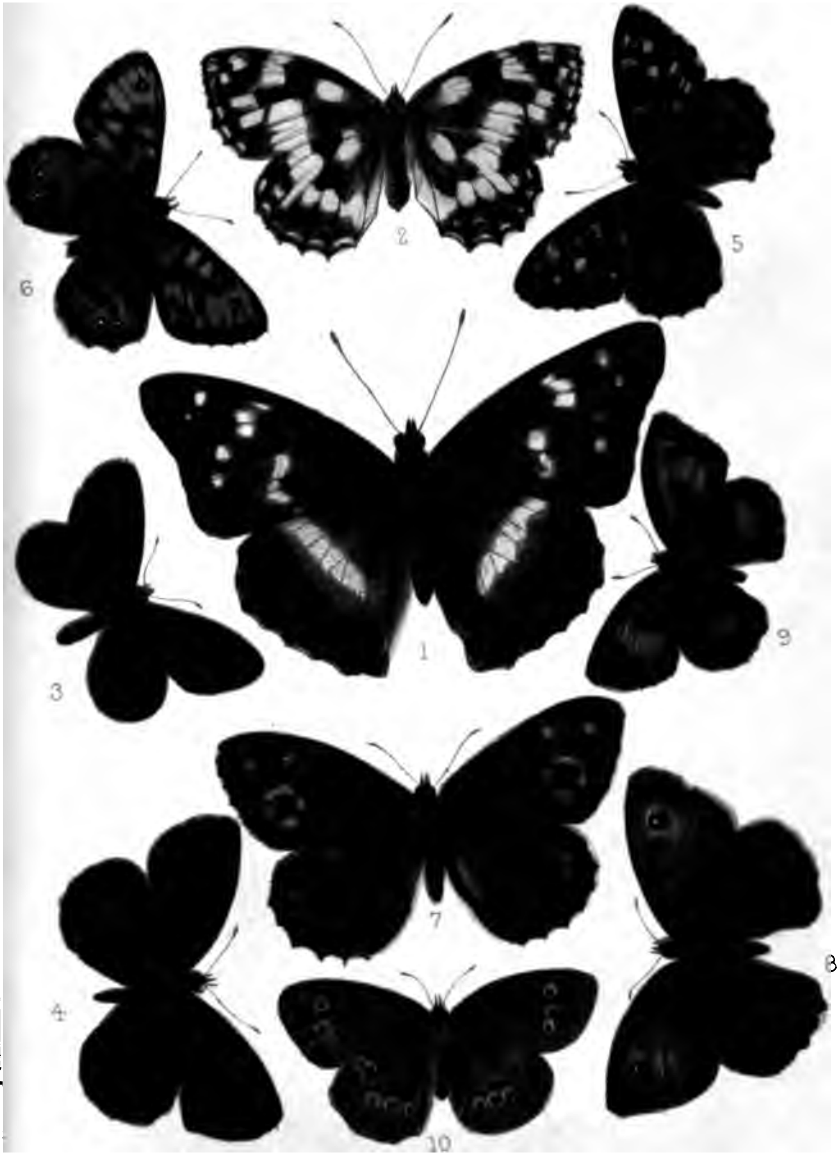

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Plate VI

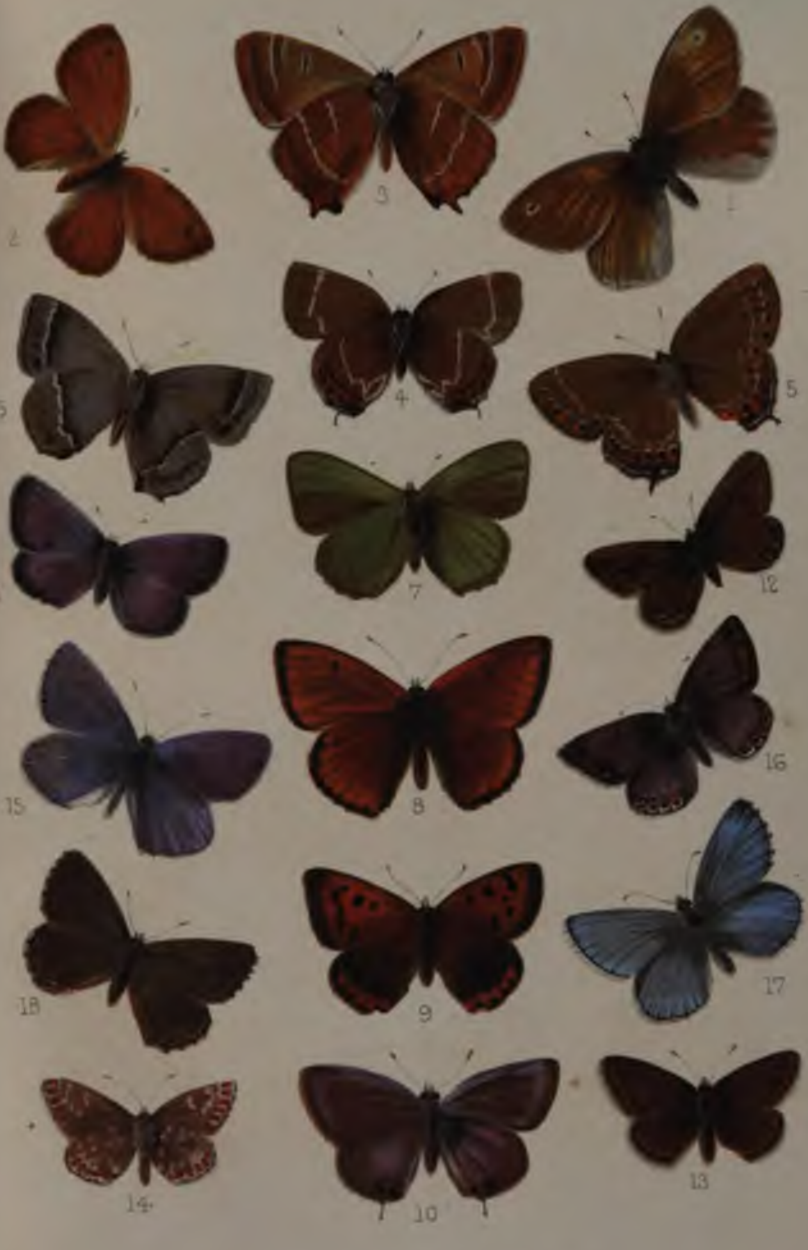

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Plate VII

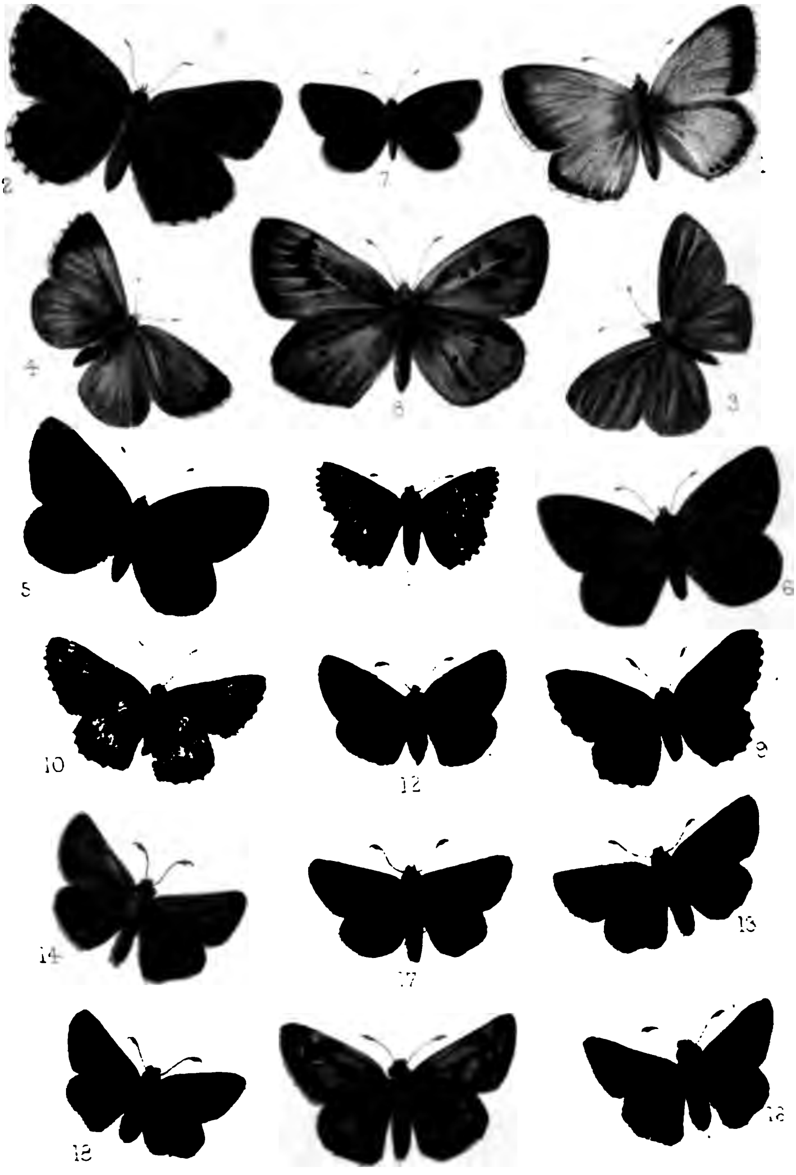

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Plate VIII

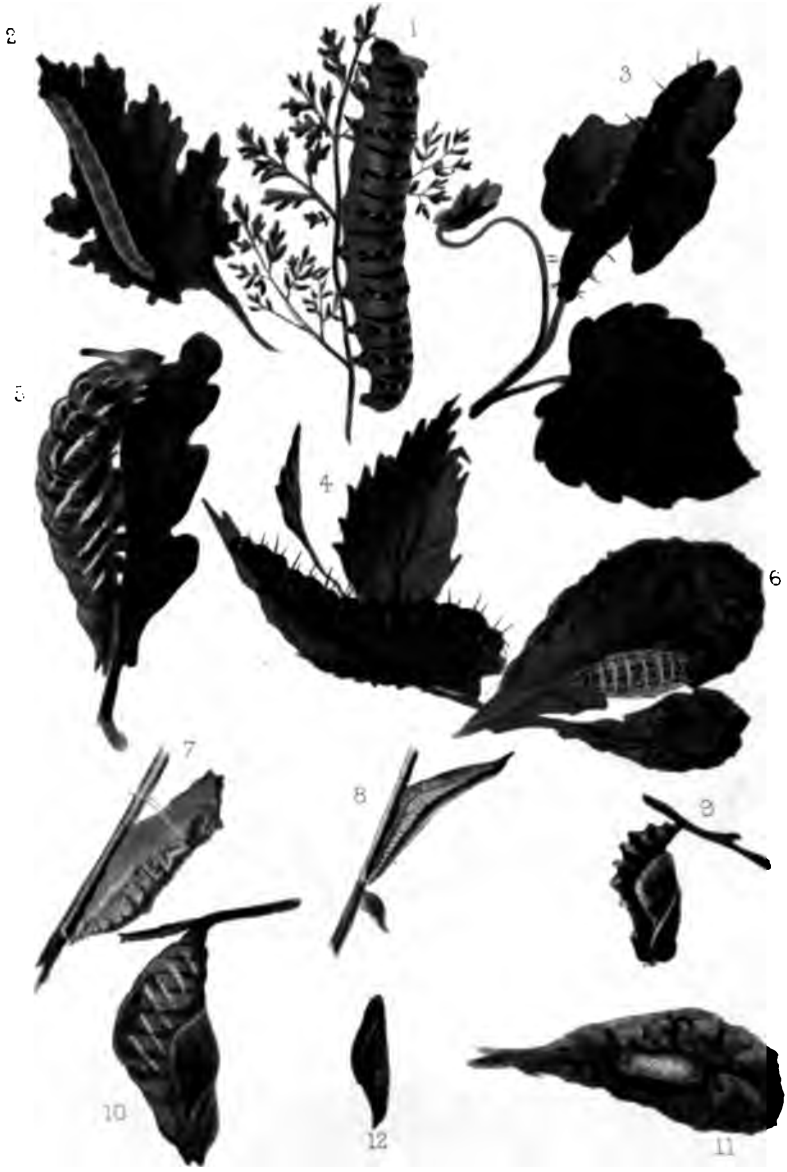

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Plate IX

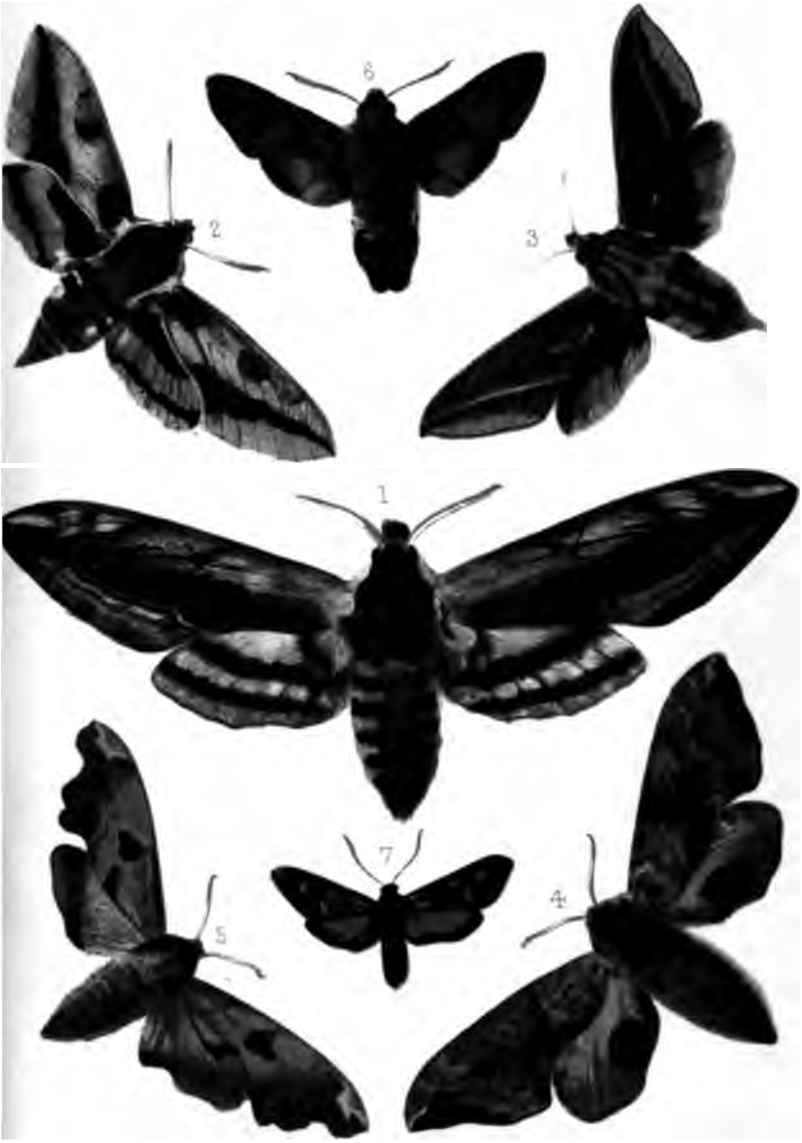

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Plate X.

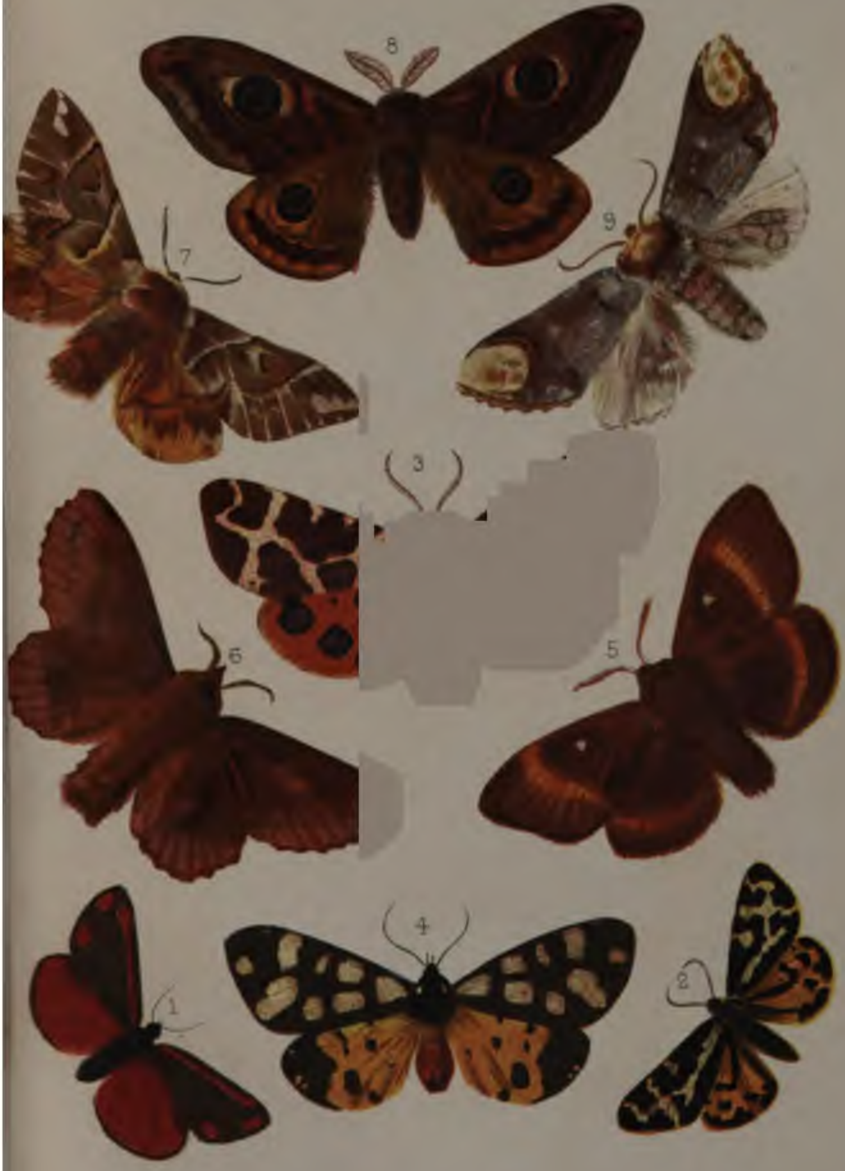

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Plate XI

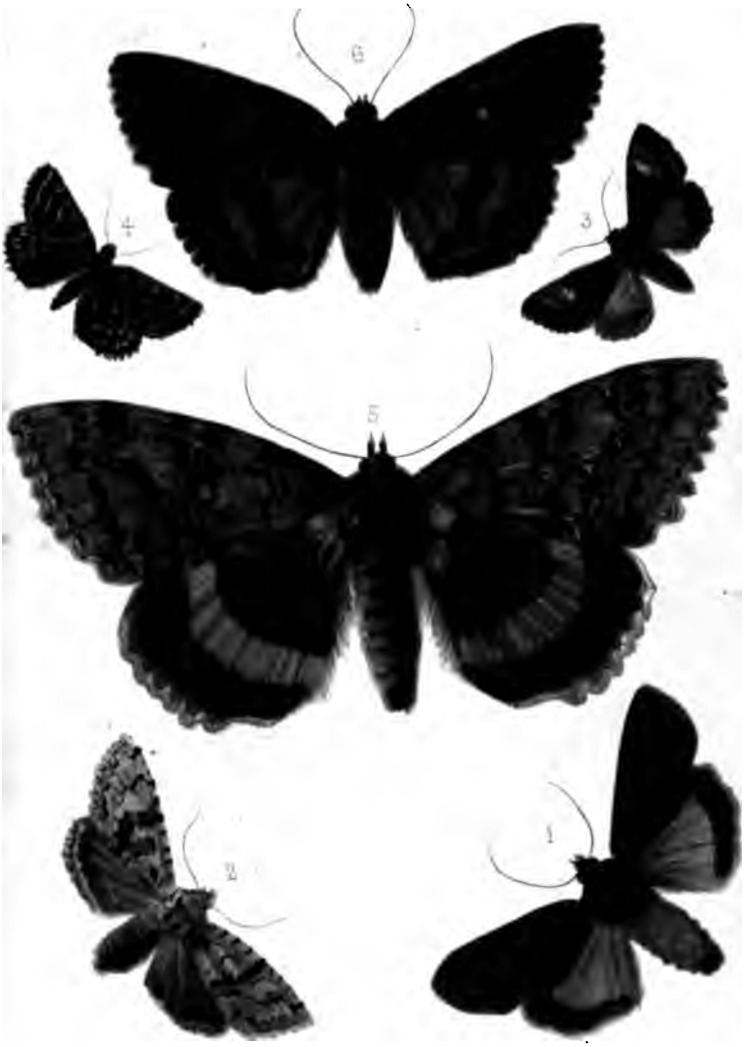

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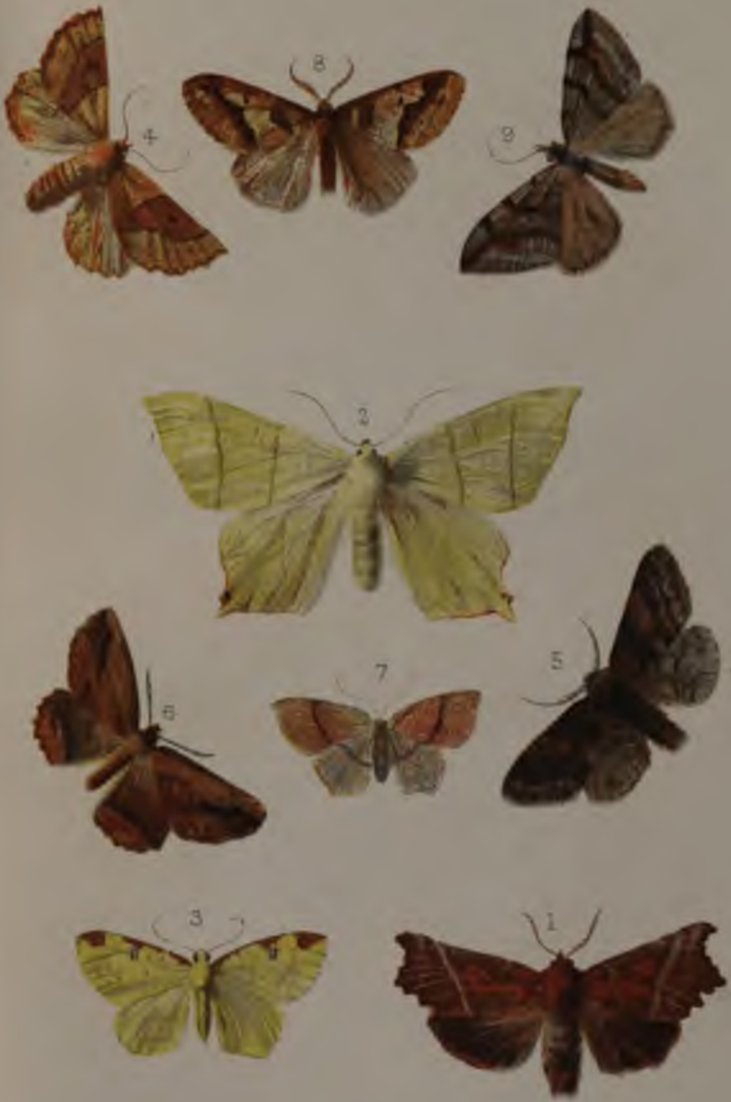
Plate XII



Danielsson & Co., del. ad. Nat. & Chromolith.

INDEX

ABBREVIATA, 284
Abraxas, 279
Abruptaria, 273
Acherontia, 204
Acidalia, 275
Acidaliidæ, 275
Aciptilia, 295
Acronycta, 240
Actæon, 199
Adela, 304
Adippe, 159
Admiral, Red, 168
Admiral, White, 170
Ægon, 189
Æscularia, 281
Æthiops, 175
Aglaia, 158
Aglossa, 291
Agriopis, 258
Agrotis, 250
Albulata, 283
Alucita, 295
Amataria, 276
Amphidasydæ, 271
Amphidasys, 272
Amphipyridæ, 254
Anaitis, 289
Angle Shades, 258
Anisopteryx, 281
Antennæ, 5
Antiopa, 167
Antiqua, 228
Antithesia, 301
Apamea, 247
Apameidæ, 244
Apatura, 171
Apiformis, 213
Aplecta, 259
Aporia, 141
Aprilina, 258
Arctia, 221
Areola, 261
Argiolus, 193
Argus, Brown, 189
Argus, Wood, 175
Argynnis, 154
Arion, 194
Arrangement of specimens, 136
Arundinis, 243
Asphalia, 238
Astrarche, 189
Atalanta, 168
Athalia, 163
Atomaria, 278
Atropos, 204
August Thorn, 271
Aurella, 306
Aurinia, 161
Aversata, 276
Axylia, 245

BÆTICA, 188
Bapta, 277
Basilinea, 247
Bath White, 146
Batis, 237
Beating for moths, 88
Beautiful Carpet, 286
Beautiful China Mark, 293
Bellargus, 191
Betulæ, 183
Betularia, 272
Bicolorata, 285
Bifida, 234
Bilineata, 287

Binaria, 232
Biston, 271
Black Arches, 227
Black Hairstreak, 184
Black-veined White, 141
Blood Vein, 276
Blue-bordered Carpet, 285
Blue Chalk Hill, 192
— Clifden, 191
— Common, 190
— Holly, 198
— Large, 194
— Mazarine, 193
— Silver-studded, 189
— Small, 194
— Tailed, 188
Boarmia, 273
Boarmiidæ, 272
Bombyces, 217
Bombycidæ, 229
Bombycoidæ, 240
Bombyx, 229
Bordered White, 279
Botys, 293
Brassicæ (*Pieris*), 142
Brassicæ (*Mamestra*), 246
Bright line Brown-eye, 260
Brimstone Butterfly, 152
Brimstone Moth, 269
Brindled Beauty, 271
Brindled Pug, 284
Broad-barred White, 257
— bordered Bee Hawk, 211
— — Five spotted Burnet, 215
Brown Argus, 189
— Hairstreak, 183
— line Bright-eye, 242
— Meadow, 178
— Northern, 175
— Tail, 226
Bryophila, 239
Bryophilidæ, 239
Bucephala, 236
Buff Ermine, 222
— Tip, 236
Bullrush, 243
Bupalus, 279
Burnets, 215
Burnished Brass, 263
Butterflies—British, 139
— antennæ of, 5
— body, 3
— catching, 64
— eye, 3
— legs, 8, 10
— proboscis, 6
— wings, 2, 8
CABBAGE MOTH, 246
Cabera, 277
Caberidæ, 276
Cabinets, 184
Caia, 221
Callimorpha, 220
C-Album, 164
Calymnia, 256
Camberwell Beauty, 167
Camelina, 235
Camptogramma, 287
Caradrina, 249
Caradrinidæ, 248
Cardamines, 148
Cardui, 169
Carpocapsa, 302
Carterocephalus, 201
Catching Butterflies, 64
— moths, 82, 85
Caterpillar state, 22
Catocala, 265
Catocalidæ, 265
Cerastis, 256
Chalk hill Blue, 192
Cheloniidæ, 220
Chequered Skipper, 201
Chestnut, 256
Chilo, 296
Chinese Character, 233
Chloroform bottle, 72
Chocolate Tip, 237
Chœrocampa, 207
Chrysalis state, 44
Chrysitis, 263
Chrysorrhœa, 226
Cidaria, 288
Cilix, 233
Cinnabar, 219
Cinxia, 162
Cirsiana, 301
Classification of Lepidoptera, 55
Clearwings, 212
Clifden Blue, 191
Clifden Nonpareil, 265
Clouded Silver, 277
Clouded Yellow, 151
Cœnonympha, 181
Coleophora, 305
Colias, 149
Collecting box, 73
Collecting larvæ, 101
— ova, 99
— pupæ, 108
Comes, 253
Comma, 164, 200
Common Blue, 190
— Carpet, 286

Common Emerald, 274
— Footman, 219
— Heath, 278
— Quaker, 255
— Swift, 223
— Wainscot, 243
— Wave, 277
Complanella, 306
Conigera, 242
Copper—Large, 187
— Small, 188
Corydon, 192
Cosmiidæ, 256
Cossidæ, 224
Cossus, 224
Coxcomb Prominent, 235
Crambi, 296
Crambus, 297
Cratægi, 141
Cream-spot Tiger, 221
Cristana, 300
Crocallis, 270
Cucullatella, 218
Cucullia, 261
Cuprella, 304
Currant Clearwing, 213
Currant Moth, 279
Curtula, 237
Cyanide bottle, 68
Cymatophoridæ, 237

Daplidice, 146
Dark Crimson Underwing, 266
Dark Dagger, 241
Dark Green Fritillary, 158
Dark Hairstreak, 185
Death's-head Hawk, 204
Decoys, 96
Defoliaria, 281
Deilephila, 207
Dentina, 259
Depressaria, 304
Dicranura, 234
Dicranuridæ, 233
Didymata, 283
Diloba, 241
Dilutata, 282
Dingy Skipper, 198
Dispar, 187, 227
Diurnea, 303
Dominula, 220
Dot, 247
Drepana, 232
Drepanulidæ, 232
Drinker, 230
Duke of Burgundy, 196
Dunbar, 256

Early Grey, 261
Edusa, 151
Egeria, 175
Eggs, 16
Elephant Hawk, 207
Elinguaria, 270
Elpenor, 208
Ematurga, 278
Emmelesia, 283
Emperor Moth, 231
Emperor, Purple, 171
Endromidæ, 231
Endromis, 231
Ennomidæ, 269
Entomological pins, 76
Ephippiphora, 301
Ephyridæ, 275
Epinephele, 178
Epiphron, 174
Erebia, 174
Erycinidæ, 196
Eubolia, 289
Euboliidæ, 288
Euchelia, 219
Eucheliidæ, 219
Euchloë, 148
Euclidia, 264
Euclidiidæ, 264
Eugonia, 271
Euphorbiæ, 207
Euphrosyne, 156
Eupithecia, 283
Euplexia, 258
Eurrhypara, 292
Exanthemata, 277
Exclamationis, 250
Eyed Hawk, 208

Fagella, 303
Farinalis, 292
Fidoniidæ, 278
Figure of Eight, 241
Filipendulæ, 215
Flame, 245
Flame Shoulder, 252
Flavago, 256
Flavicornis, 238
Flounced Rustic, 246
Fluctuata, 287
Forester, 214
Forficalis, 293
Fraxini, 265
Fritillaries, 154
Fritillary, Dark Green, 158
— Glanville, 162
— Greasy, 161

Fritillary, Heath, 163
— High Brown, 159
— Pearl-bordered, 156
— Queen of Spain, 156
— Silver-washed, 159
— Small Pearl-bordered, 154

Galatea, 173
Galleria, 298
Gamma, 264
Garden Carpet, 287
Garden Dart, 251
Garden Pebble, 293
Gemmaria, 273
Geoffrella, 305
Geometra, 274
Geometræ, 268
Geometridæ, 274
Ghost Swift, 223
Gipsy, 227
Glaucata, 233
Goat Moth, 224
Gonodactyla, 294
Gonoptera, 264
Gonopteridæ, 262
Gonopteryx, 152
Gortyna, 244
Gothic, 254
Grass Rivulet, 283
Grayling, 177
Grease, 127
Greasy Fritillary, 161
Green Hairstreak, 186
Green-chequered White, 146
Green Silver-lined, 217
Grizzled Skipper, 197
Grey Arches, 259
Grey Dagger, 240
Grossulariata, 279

Hadena, 259
Hadenidæ, 257
Hairstreak, Black, 184
— Brown, 183
— Dark, 185
— Green, 186
— Purple, 185
— White-letter, 184
Halia, 278
Hamellus, 297
Harpella, 305
Hawk Moths, 204
Heart and Dart, 250
Heath, Large, 179
— Moth, 278
Heath, Small, 181
— Fritillary, 163
Hecatera, 257
Helice, 151
Hemerophila, 278
Hemithea, 274
Hepialidæ, 223
Hepialus, 223
Herald Moth, 262
Hesperia, 198
Hesperiidæ, 197
Hexadactyla, 295
High Brown Fritillary, 159
Hirtaria, 271
Holly Blue, 193
Hornet Clearwing of Osier, 213
Hornet Clearwing of Poplar, 21
Hortuellus, 297
Humming-bird Hawk, 210
Humuli, 223
Hyale, 149
Hybernia, 280
Hyberniidæ, 280
Hydrocampa, 293
Hylophila, 217
Hyperanthus, 180
Hyponomeuta, 304

Ianira, 178
Ianthina, 252
Ibipenella, 305
Icarus, 190
Ichneumon flies
Impura, 243
Ino, 214
Io, 167
Iris, 171

Jacobææ, 219

Kentish Glory, 231
Killing bottle, 68
Killing box, 70

Labial palpi, 6
Lace Border, 275
Lappet, 230
Larentia, 283
Larentiidæ, 282
Large Blue, 194
Large Copper, 187
Large Elephant, 208
Large Emerald, 274

Large Heath, 179
Large Skipper, 200
Large Tortoiseshell, 165
Large White, 142
Large Yellow Underwing, 253
Larvæ, 22
Larvæ Beating, 107
Larvæ, blowpipe for, 131
Larva boxes, 101
Larva cage, 115
Larvæ collecting, 101
Larvæ, glass for, 114
Larvæ rearing, 118
Lasiocampa, 230
Latona, 56
Laurel box, 70
Leaf Miners, 33, 903
Leaf Rollers, 33, 303
Lecheana, 300
Legs of Lepidoptera, 8, 10
Leioptilus, 295
Leopard Moth, 225
Lepidoptera—antennæ, 5
— body, 3
— classification of, 55
— eggs of, 16
— general characteristics, 1
— legs of, 8, 10
— metamorphoses, 14
— proboscis, 6
— wings, 2, 8
Lesser Broad Border, 252
Lesser Yellow Underwing, 253
Leucania, 242
Leucaniidæ, 242
Leucophasia, 149
Leucophearia, 280
Libatrix, 262
Light Arches, 245
Light Emerald, 270
Light Traps, 87
Ligniperda, 224
Ligustri, 206
Lime Hawk 210
Limenitis, 170
Limitata, 289
Lineola, 199
Liparidæ, 226
Lithosia, 218
Lithosiidæ, 219
Lithoxylea, 245
Lobophora, 285
Lobster Moth, 28
Lophopteryx, 235
Lubricipeda, 222
Lucina, 196
Lucipara, 258
Lulworth Skipper, 199
Luperina, 246
Lupulinus, 223
Luteolata, 269
Lycæna, 183, 188
Lycænidæ, 183

Macariidæ, 278
Machaon, 39
Macroglossa, 210
Maiden's Blush, 275
Malvæ, 197
Mamestra, 246
Mania, 254
Marbled Beauty, 289
Marbled Minor, 248
Margaritaria, 270
Marsh Moth, 281
Marsh Ringlet, 181
Marvel-du-jour, 258
Maura, 254
Mazarine Blue, 193
Meadow Brown, 178
Meal Moth, 292
Megacephala, 241
Megæra, 177
Melanargia, 173
Melanthia, 285
Melitæa, 161
Mellonella, 298
Menthastri, 222
Meticulosa, 258
Metrocampa, 270
Mi, 264
Miana, 248
Micro-lepidoptera, 290
Minima, 194
Monacha, 227
Montanata, 286
Morpheus, 249
Mother-of-pearl, 293
Mother Shipton, 264
Moths, 203
— antennæ of, 5
— catching, 82
— traps, 87
Mottled Rustic, 249
Mottled Umber, 281
Mundana, 218
Muslin Moth, 218

Nanata, 284
Napi, 145
Narrow-winged Pug, 284
Nebulosa, 259

Nemeobius, 196
Nemeophila, 220
Nepticula, 306
Nervosa, 304
Nets, 65, 87, 91
Netted Pug, 283
New Small Skipper, 199
Nigricans, 251
Nisoniades, 198
Noctua, 252
Noctuæ, 239
Noctuidæ, 249
Nola, 218
Nolidæ, 218
Nonagria, 243
Northern Brown, 175
Notodontidæ, 235
November Moth, 282
Nudaria, 218
Nupta, 266
Nycteolidæ, 217
Nymphalidæ, 154

Oak Eggar, 229
Oak Hook Tip, 282
Ocellatus, 208
Ochracea, 244
Ocneria, 227
Octomacularia, 301
Odonestis, 230
Old Lady, 254
Oleracea, 260
Oporabia, 282
Orange Tip, 148
Orgyia, 228
Ornata, 275
Orthosiidæ, 255
Osteodactylus, 295
Ova collecting, 99
Ova preserving, 130

Padellus, 304
Painted Lady, 169
Palæmon, 201
Pale Clouded Yellow, 149
Pallens, 243
Palpi, 6
Pamphilus, 181
Paphia, 159
Papilio, 139
Papilionaria, 274
Papilionidæ, 139
Pararge, 175
Pavonia, 231
Peach Blossom, 237
Peacock, 167
Pearl-bordered Fritillary, 158
Pentadactyla, 295
Penthina, 300
Peppered Moth, 272
Perla, 289
Peronea, 300
Persicariæ, 247
Phalera, 236
Phlæas, 188
Phlogophora, 258
Phragmitellus, 296
Pieridæ, 141
Pinguinalis, 291
Piniaria, 279
Pink-barred Sallow, 256
Pins, 76
Pionea, 298
Plagiata, 289
Plantaginis, 220
Platyptilia, 294
Plecta, 252
Plusia, 263
Plusiidæ, 263
Polychloros, 165
Polyommatus, 187
Poplar Grey, 241
Poplar Hawk, 209
Poplar Kitten, 234
Populi, 209
Porcellus, 207
Porthesia, 226
Potatoria, 230
Prasinana, 217
Preserving larvæ, 131
— ova, 130
— pupæ, 133
Privet Hawk, 206
Proboscis, 6
Pronuba, 253
Pruni, 185
Pruniana, 300
Psi, 240
Psilura, 227
Pterophori, 294
Ptycholoma, 300
Punctaria, 275
Pupa state, 44
Pupæ collecting, 108
— digging, 111
— management of, 118
— preserving, 133
Purple Emperor, 171
Purple Hairstreak, 185
Puss Moth, 235
Putris, 245
Pygæra, 237

Pygæridæ, 236
Pyralides, 291
Pyralis, 292
Pyrina, 225

QUEEN of Spain, 156
Quercifolia, 230
Quercinaria, 271
Quercus (*Bombyx*), 229
Quercus (*Thecla*), 185

RAPÆ, 144
Rearing larvæ, 113
Red Admiral, 168
Red Underwing, 266
Relaxing, 125
Rhamni, 152
Riband Wave, 276
Ringlet, 180
— Marsh, 181
— Small, 174
Rubi, 186
Rumia, 269
Ruralis, 293
Rustic Shoulder-knot, 247

SALICELLA, 301
Sambucaria, 268
Saturnia, 231
Saturniidæ, 231
Satyridæ, 173
Satyrus, 177
Scalloped Oak, 270
Scarlet Tiger, 220
Sciaphila, 301
Segetum, 250
Selene, 154
Semele, 177
Semiargus, 193
Serena, 257
Sesia, 213
Sesiidæ, 212
Setting boards, 122
Shark, 261
Shears, 259
Short-cloaked, 218
Sibylla, 170
Silaceata, 288
Silver-ground Carpet, 286
Silver-spotted Skipper, 200
Silver-studded Blue, 189
Silver-washed Fritillary, 159
Silver Y, 264
Sinapis, 149
Six-spot Burnet, 215
Skippers, 196
Skipper, Chequered, 201
— Dingy, 198
— Grizzled, 197
— Lulworth, 199
— New Small, 199
— Silver-spotted, 200
— Small, 198
Sleeving, 116
Small Angle Shades, 258
— Blue, 194
— Copper, 188
— Elephant, 207
— Heath, 181
— Magpie, 292
— Mallow, 289
— Pearl-bordered Fritillary, 154
— Phœnix, 288
— Ringlet, 174
— Seraphim, 285
— Skipper, 198
— Tortoiseshell, 166
— White, 144
Smerinthus, 208
Smoky Wainscot, 243
Sociata, 286
Speckled Wood, 175
Sphinges, 203
Sphingidæ, 204
Sphinx, 206
Spilosoma, 222
Sponsa, 266
Spring Usher, 280
Spurge Hawk, 207
Stabilis, 255
Stagnata, 293
Statices, 214
Stellatarum, 210
Store boxes, 185
Strigata, 274
Strigilis, 248
Stuffing insects, 126
Sugaring, 92
Sugaring net, 94
Sugar traps, 96
Swallow-tail Butterfly, 139
Swallow-tail Moth, 268
Swifts, 223
Sylvanus, 200
Syrichthus, 197

TABBY, 291
Tæniocampa, 255
Tages, 198
Tailed Blue, 188

Temerata, 277
Testacea, 246
Thaumas, 198
Thecla, 183
Thyatira, 237
Tiger, Common, 221
— Cream-spot, 221
— Scarlet, 220
— Wood, 220
Tiliæ, 210
Timandra, 276
Tineæ, 303
Tipuliformis, 213
Tithonus, 179
Tortoiseshell, Large, 165
Tortoiseshell, Small, 166
Tortrices, 298
Treble Bar, 289
Trifolii, 215
Tristellus, 297
Trochilium, 213
Tryphæna, 252
Turnip Moth, 250
Twin-spot Carpet, 283
Typhon, 181
Typica, 254

Umbricata, 261
Uropterygidæ, 268
Uropteryx, 268
Urticæ, 166
Urticata, 292

Vaccinii, 256
Vanessa, 164
Vapourer Moth, 228
Vauaria, 278
Venosata, 283
Versicolor, 231
Villica, 221
Vinula, 235
Viridana, 299
V moth, 278

W album, 184
Wainscots, 243
Wall Butterfly, 177
Waved Umber, 278
White Admiral, 170
— Bath, 146
— Black-veined, 141
— Ermine, 222
— Green-chequered, 146
— Green-veined, 145
— Large, 142
— -letter Hairstreak, 184
— Marbled, 173
— Small, 144
— Wood, 149
Willow Beauty, 273
Wings, 2, 8
Wood Argus, 175
Wood Tiger, 220
Wood White, 149

Xanthia, 256
Xanthosetia, 302
Xylinidæ, 261
Xylocampa, 261
Xylophasia, 245
Xylosteana, 299

Yellow-horned, 288
Yellow Shell, 287

Zerenidæ, 279
Zeuzera, 225
Zoegana, 302
Zonosoma, 275
Zygæna, 215
Zygænidæ, 214

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